MEMOIRS

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RECORD OF FISHES OBTAINED BY DAVID STARR JORDAN IN JAPAN, 1922.

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NATIONAL MUSEUM

By David Starr Jordan and Carl Leavitt Hubbs.

(The Salmonidæ by David Starr Jordan and Ernest Alexander McGregor.)

(Plates V–XII.)

INTRODUCTORY.

The senior author spent the months of October and November, 1922, in Japan on the occasion of a third visit to that country. In connection with educational work and social duties he found time to make the rounds of the fish-markets in several cities, and with the help of naturalist friends was able largely to supplement his previous collections. These were the series collected in association with Professor John Otterbein Snyder in 1900, and that obtained by himself in 1911. The first of these collections has been described, group by group, in numerous papers in the *Proceedings of the United States National Museum.* The second was recorded by Jordan and Thompson (William Francis) in the *Memoirs of the Carnegie Museum,* Vol. VI, Sept. 1914, pp. 205–313.

The present collection was delivered in California without charge through the continued courtesy of Mr. Sochiro Asano, President of the Toyo Kisen Kaisha (Oriental Steamship Company), and his Assistant, Mr. Yoshio Yeto, a former student of the senior author. To two former students, Dr. Toshiyasu Kuma of Tokyo and Henry Chamberlain of Los Angeles, we may also express our indebtedness for various helpful services.

The Imperial Universities of Tokyo, Kyoto, and Sapporo took special interest in the work, sending out members of their staffs in different directions to secure material and to assist in various ways.

The collection of 1922, numbering five hundred and twenty-five species, consists of the following:

1. Specimens obtained by Jordan in the markets of Tokyo, Yokohama, Shizuoka, Nagoya, Kachi River, Lake Suwa, Lake Biwa, Yodo River, Osaka, Kyoto, Kobe, Nara, Yamada in Ise, and Toba. The material from Tokyo all comes to market by way of Yokohama, mostly from the shores of Shimosa, Boshu, and Sagami (Misaki). That from Osaka, Kyoto, and Nara is mostly from the Inland Sea, landed at the port of Kobe; the market of Yamada is mainly supplied from Toba.

2. Specimens of young salmon, or trout, collected in the Shibu River (Shibugawa) near Ikao, Kotsuke, in Central Japan, on a special trip by Dr. Chiyomatsu Ishikawa of the College of Agriculture in the Imperial University of Tokyo.

3. Material selected by Dr. Ishikawa and Dr. Yōjirō Wakiya (now Director of Fisheries in Korea) from the accumulations of the College of Agriculture.

List of localities in Collection 3.

(On each of the specimens numbered cloth-tags are attached, with the initials 'I. W.' (Ishikawa and Wakiya).

Lake Kawaguchi, and Lake Yamanaka, Province of Koshu, near Fujiyama (Masashi Ishikawa), Nos. 1–27.
Mikawa, province of Mikawa, near Nagoya (M. Ishikawa), Nos. 28–200.
Nagano, Shinshu, (Nagano Ken Fishery Institution), Nos. 201–220.
Himeji, Harima (Ryohei Abe), Nos. 221–305.
Okayama, Bizen (Kumachichi Mikamo), Nos. 306–334.
Toyama, Etchu (Shosaku Yoshizawa), Nos. 335–343; 459–535.
Akita, Ugo, north western Japan (Akita-Ken Experiment Station), Nos. 344–359.
Wakayama, Kishu (Kyoto Imperial University), Nos. 360–386.
Chikuma River, Lake Suwa, and Lake Kizaki, Shinshu, (T. Ota) Nos. 387–420.
Aomori, Mutsu (Yoshimo Beppu), Nos. 421–427.
Choshi, Shimosa (Ch. Ishikawa), Nos. 428–444.
Shibu River, Gumba, near Ikao (mountain-stream flowing into the Pacific (Ch. Ishikawa), Nos. 445–457.
Yamaguchi, Suwo, (Yamaguchi Agricultural Station), Nos. 458–468.
Miyazu,Tango (Kyoto Fisheries Institute), Nos. 536–652.
Fukuoka, Chikuzen (Shunsaburo Hamada), Nos. 653–690.
Noo, near Niigata, Echizen (Noo Fishery School), Nos. 691–803.
Iwate, Rikuchu (Kyoji Awai), Nos. 804–818.
Lake Kozan and Lake Tojo, Tattori, Inabe (Shiyiro Inomata), Nos. 912–918.

4. A large collection from Misaki, made by the veteran fisherman of the Marine Laboratory, Kumakichi Aoki, affectionately known as Kuma, who has again raided the rock-pools and dipped into the depths of the inexhaustible Bay of Sagami. In this lot there are one hundred and eighty species, indicated by the initial 'A'.

5. Collections made by Dr. Wakiya in Lake Biwa, Kagoshima Bay, Kumamoto, and other localities on the island of Kyūsyū and from various bays and streams in southwestern Japan, as well as at Fusan and in the Ping-yang River in Korea.

List of localities in Collection 5. (Wakiya)

(On each of the specimens taken by Dr. Wakiya is a cloth-tag, with number and the letter 'W'.)

Kagoshima Bay, Satsuma, Nos. 1–291.
Brooks at Yamawa, near Kagoshima, Nos. 292–302.
Bay of Ariake, Nos. 334–335.
River at Kumamoto, Nos. 336–473.
River at Ozu, province of Iyo, Shikoku, Nos. 474–488.
River at Hamada in Iwami, Nos. 489–513.
Lake Biwa, Nos. 514–528.
Ping-Yang River, Chosen, Nos. 529–535.
Uwajima, Iyo, Shikoku, No. 536.
Kuma River near Kumamoto, Nos. 537–538.
River at Hamada, Iwami, Nos. 539–541.
Jiutsu River, near Toyama, Hida, No. 542.
Mouth of the River Kitakami near Sendai, Rikuzen, Nos. 545–547.
Upper tributaries of Kiso River in Shinshu, No. 548.
Hachi, Komashiba, Fukui, Hino River, and Lakes Kitagata and Mikata, Echizen, (Kohei Nonaka) Nos. 919–967.
Lake Kasumigaura, Mito (Kanematsu Hattori) Nos. 987–1031.

6. Specimens from Otaru and Takashima made by I. Moriwaki, Chief of the Hokkaido Fisheries Experiment Station at Takashima, sent through Professor Shigeho Tanaka of the Imperial University of Tokyo.

7. Specimens from Kushiro market from K. Akitani, Chief of the Kushiro Fisheries Substation, sent through Professor Tanaka.

8. Specimens from Nemuro market, from T. Murakami, Chief of the Nemuro Fisheries Substation, sent through Professor Tanaka.

9. Specimens sent from the Imperial University of Sapporo, through Professors S. Nozawa, and Madoka Sasaki; these obtained about Otaru and Sapporo, by Messrs. S. Takayasu and Toyozi Majima.

10. Specimens obtained by Professor Senzi Yamamoto of the Imperial University of Kyoto at Wakanoura in Kishu, and in company with the senior author at Osaka, Kobe, Yamada, and Toba.

11. Specimens obtained with the help of Professor Tamiji Kawamura of the Imperial University of Kyoto, in Lake Biwa at Otsu, a few added from previous collections in different localities.

12. Specimens presented by a former student, Professor Yoshiro Manabe of the Kansei Gakuin (College) of Kobe, by Kokichi Mikimoto from his pearl-fisheries at Tatoku Island in Shima, and Yasukei Tsuchiga, a teacher of science in the local "Middle School" of Yamada.

13. Specimens collected by Mr. M. Gist Gee at Soo-chow, China, and sent by Dr. Cora B. Reeves to the Museum of Zoology of the University of Michigan.

14. Specimens collected about 1908 by the late Professor Keinosuke Otaki, mostly on the coast of Echigo (Naoetsu). These have been specially studied by Mr. Kasawa.

The material obtained has been distributed among different museums, the types of new species, with all those figured in the present paper and many others, being placed in the Carnegie Museum in Pittsburgh. The Catalog numbers attached to the specimens in the Carnegie Museum are given in the following pages.

A second series is in the American Museum of Natural History, New York; a third in the Museum of the University of Michigan; and a fourth in Cornell University. The residue are being retained at Stanford University in California.

The sequence adopted in the present record is that of the *Catalogue of the Fishes of Japan* by Jordan, Tanaka, and Snyder, published on March 31, 1913, by the Imperial University of Tokyo. In this Catalogue one thousand two hundred and forty species are enumerated from Japan proper, exclusive of Formosa, the Bonin, and the Ryūkyū Islands. About one hundred species have been since added, most of them through the researches of Dr. Tanaka. In the present list each species is given (in brackets) the number assigned to it by Jordan, Tanaka, and Snyder. Species not obtained in 1922 are not included in the present list, and in general matter already in print is not here repeated.

The accounts of the *Salmonidæ* in the present paper are the joint work of the senior author and Mr. Ernest Alexander McGregor, a former student, now Assistant to the California State Fish and Game Commission, engaged at Stanford University in a detailed study of the development of the salmon of the Pacific Coast. The account of the Sea Cat-fish, *Netuma osakæ,* was prepared in collaboration with Mr. Masanosuke Kasawa of Sapporo, an advanced student at work on the fishes of the Hokkaido. Other assistance has been given by Mr. McGregor and Mr. Kasawa.

The following new genera are described in this paper:

PHASMICHTHYS (*mitsukurii*) Chimæridæ;
PANTOPHOS (*glandulifer*) Myctophidæ;
LAMPROSSA (*anteorbitalis*) Myctophidæ;
BELLIGOBIO (*eristigma*) Cyprinidæ;
ACAHARA (*semotilus*) Cyprinidæ;
MOROCO (*bergi*) Cyprinidæ;
ANAGO (*anago*) Congridæ;
CONGRISCUS (*megastomus*) Congridæ;
ASTROCONGER (*myriaster*) Congridæ;
ALLOCONGER (*flavirostris*) Congridæ;
RHYNCHOCYMBA (*nystromi*) Congridæ;
RHYNCHOCONGER (*ectenurus*) Congridæ;
CONGRINA (*æquorea*) Congridæ;
SAWARA (*niphonia*) Cybiidæ;
KISHINOELLA (*rara*) Thunnidæ;
OCYCRIUS (*japonicus*) Centrolophidæ;
TRIORUS (*tritropis*) Ostraciidæ;
SEBASTOCLES (*elegans*) Scorpænidæ;
WAKIYUS (*spinosus*) Platycephalidæ;
COCIUS (*crocodilus*) Platycephalidæ;
RUTABULUS (*megacephalus*) Platycephalidæ;
OCELLA (*dodecaëdron*) Platycephalidæ;
IBURINA (*iburia*) Agonidæ;
IBURIELLA (*kasawæ*) Agonidæ;
ENCÆURA (*evides*) Eleotridæ;
ZALESCOPUS (*tosæ*) Uranoscopidæ;
DASSON (*trossulus*) Blenniidæ;
ONCESTHES (*fluctuans*) Blenniidæ;
ZESTICHTHYS (*tanakæ*) Zoarcidæ;
ALLOLEPIS (*hollandi*) Zoarcidæ;

The species listed below are described as new:

Dasyatis ushiei Jordan and Hubbs;
Psychichthys eidolon Jordan and Hubbs;
Oncorhynchus adonis Jordan and McGregor;
Oncorhynchus kawamuræ Jordan and McGregor;
Oncorhynchus ishikawæ Jordan and McGregor;
Oncorhynchus rhodurus Jordan and McGregor;
Salvelinus imbrius Jordan and McGregor;
Netuma osakæ Jordan and Kasawa;
Gnathopogon suwæ Jordan and Hubbs;
Gnathopogon majimæ Jordan and Hubbs;
Gnathopogon longifilis Jordan and Hubbs;
Gnathopogon tsuchigæ Jordan and Hubbs;
Belligobio eristigma Jordan and Hubbs;
Sarcocheilichthys morii Jordan and Hubbs;
Acahara jusanensis Jordan and Hubbs;
Moroco yamamotis Jordan and Hubbs;
Pneumatophorus peruanus Jordan and Hubbs;
Liopempheris sasakii Jordan and Hubbs;
Malakichthys wakiyæ Jordan and Hubbs;
Sebastodes thompsoni Jordan and Hubbs;
Brachirus bellus Jordan and Hubbs;
Iburiella kasawæ Jordan and Hubbs;
Encæura evides Jordan and Hubbs;
Tænioides snyderi Jordan and Hubbs;
Zalescopus tosæ Jordan and Hubbs;
Zalescopus satsumæ Jordan and Hubbs;
Zestichthys tanakæ Jordan and Hubbs;
Allolepis hollandi Jordan and Hubbs;
Monomitopus kumæ Jordan and Hubbs;
Cœlorhynchus gilberti Jordan and Hubbs;

The following additional species are here recorded for the first time as belonging to the fish-fauna of Japan proper:

Heterodontus zebra (Gray);
Pentanchus species;
Stoasodon narinari (Euphrasen);
Coilia ectenes Jordan and Seale;
Diaphus latus Gilbert;
Lamprossa anteorbitalis (Gilbert);
Pantophos glandulifer (Gilbert);
Gasterosteus aculeatus microcephalus (Girard);
Gymnosarda nuda (Günther);
Cæsio lunaris Ehrenberg;
Cæsio cæruleoaureus (Lacépède);
Cæsio chrysozonus Kuhl and Van Hasselt;
Upeneoides vittatus (Forskål);
Nibea albiflora (Richardson);
Othonias undovittatus (Jordan and Seale);
Cantherines tessellatus (Günther);
Arnoglossus tenuis Günther;
Oncesthes fluctuans (Weber);

The excellent plates in the present paper, as also in an earlier memoir on the Fishes of Hawaii, were prepared by the late William Sackston Atkinson, Natural History Artist of Stanford University.

Family EPTATRETIDÆ.

1. [2] **Eptatretus burgeri** (Girard). *Nuta-unagi* = Salad-Eel.

A specimen of this well-known hag-fish was taken by Aoki at Misaki.

2. [3] **Eptatretus okinoseanus** (Dean).

This hag-fish is represented in Aoki's collection from Misaki by a single specimen, which agrees well with Dean's account.

3. [5] **Paramyxine atami** Dean.

Three examples of this hag-fish, regarded by Dean as transitional between the *Eptatretidæ* and the *Myxinidæ*, were collected by Aoki at Misaki.

Family PETROMYZONIDÆ.

4. [6] **Entosphenus japonicus** (Martens). *Yatsume-unagi* = Eight-eyed Eel.

Nine specimens of the Sea-run Lamprey of Japan, Alaska, and northern Asia were obtained by Mr. S. Takayasu from Karafuto near Otaru in western Hokkaido.

These are all typical: size large; myotomes numerous; oral fimbriæ rather narrowly palmate; dorsal fins separate; teeth strong and sharp; extra-orals strong, but restricted to front of disc; laterals all bicuspid; three on each side of the mouth; supra-oral widely and sharply bicuspid, with at most a barely perceptible median denticle; infra-oral with eight to ten (usually eight) cusps, of which the outer two on each side are more or less completely fused, leaving four (usually) to six unjoined cusps medially; laterals connected posteriorly by a half ring of small but prominent teeth.

The distribution and characteristics of this species have lately been discussed by Creaser and Hubbs.[1]

5. [7] **Entosphenus mitsukurii** (Hatta). *Sunayatsuma* = Sand-Eight-eyed Eel, or Lamprey.

The degenerate Brook-lampreys of Japan have been referred by Regan and by Jordan, Tanaka, and Snyder, to the European *Lampetra planeri*, while Creaser and Hubbs in their last review of the family[2] although showing the species *mitsukurii* to be an *Entosphenus*, still thought that *Lampetra planeri* also occurred in Japan. On re-examining the material of this group in the Stanford collections we find nothing but *Entosphenus mitsukurii*, and only that species is represented in the collection upon which we are now reporting. We think it improbable that *Lampetra planeri* occurs in Japan.

Entosphenus mitsukurii differs from the commonest of the three Brook-lampreys of the eastern United States, namely *Entosphenus appendix*, with which Creaser and Hubbs confused it, in having fewer myotomes and less palmate oral fimbriæ. It is closely related to *E. appendix*, however, and both of these brook-forms were obviously derived from a sea-run species like *Entosphenus japonicus*. These three species together comprise a distinct group, called *Lethenteron* by Creaser and Hubbs.

Like the Brook-lampreys of other regions, those of Japan break up into a complex of local races, differing in degree of degeneration. For this reason we list our specimens separately.

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[1] Occas. Pap., Mus. Zoöl., Univ. Mich., No. 120, 1922.

[2] *Ibidem.*

An ammocœte, 131 mm. long, collected by S. Nakano in Shinshu, has fifty-six myotomes between the last gill-opening and the anus.

Two recently transformed specimens, with the teeth soft and imperfect (but typically arranged) were taken by R. Abe at Himeji. One is a female with developed anal fin; 92 mm. in total length, with fifty-nine myotomes in the trunk. The other is a male, with elongate penis; 86 mm. in total length; fifty-eight myotomes.

Two examples, 121 and 145 mm. long, were taken in Lake Biwa. Myotomes fifty-six or fifty-seven. Two from Sapporo, Hokkaido, presented by Dr. Kawamura, are especially aberrant. One is a mature male, 147 mm. long, with sixty-seven myotomes in standard count, and the coloration mottled. The other is a mature female, 142 mm. long, with sixty-three myotomes and the coloration plain.

Family CHLAMYDOSELACHIDÆ.

6. **Chlamydoselachus anguineus** Garman. *Rabuka* = Silk-shark; *Tokagi-zame* = Lizard-shark.

A stuffed example of this anomalous shark from Sagami Bay is in the Museum at Yamada, Ise. With others it was presented by Baron Y. Tanaka.

Family HETERODONTIDÆ.

7. [12] **Heterodontus japonicus** (Dumeril). *Neko-zame* = Cat-shark; *Shansho-zame* = Salamander-shark.

A small specimen of this shark was taken at Misaki by Aoki. A stuffed example from the coast of Ise is in the Yamada Museum.

8. [12A] **Heterodontus zebra** (Gray).

A heterodontid shark from the Osaka market (Jordan) differs widely from *Heterodontus japonicus,* the only species hitherto known from Japan, but agrees fully with Garman's account[3] of *H. zebra,* a Chinese and East Indian species.

Family SCYLLIORHINIDÆ.

9. [19] **Apristurus platyrhynchus** (Tanaka). *Hira-zame* = Flat-shark; *Shiribire-onaga-zame* = Long-tailed Shark.

Scylliorhinus platyrhynchus Tanaka, Jour. Coll. Sci., Tokyo, XXVII, 1909, p.4.
Apristurus platyrhynchus Garman, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 98.

A mounted specimen from Sagami, apparently belonging to this species, is in the Museum at Yamada.

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[3] Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 181.

Family PENTANCHIDÆ.

10. [23A] **Pentanchus** undescribed species. *Kagura-zame* = Lion-shark.

A mounted specimen of this species is in the Yamada Museum. It is said that others have been taken on the coasts of Japan, but as yet no description of the form has been published.

The single dorsal fin is placed above the anal, which is twice as large; both these fins are low; the ventrals much larger than either, and inserted behind the middle of the body; pectoral small; caudal short and rather low. Gill-openings five, the first much higher than the others, which are progressively shortened.

The species seems to differ from *Pentanchus profundicolus* Smith and Radcliffe from the Philippines in the larger ventrals and smaller pectorals. We may leave it to the Japanese naturalists to name and describe.

Caninoa barbarus Nardo, an unrecognized species from the Mediterranean, is much like *Pentanchus*, but the single dorsal is merely described as "behind the ventral."

Family GALEORHINIDÆ.

Genus CYNIAS Gill.

The name *Cynias* Gill must stand for the "Spotted hounds," with *Mustelus canis* or *stellatus* as type, as Gill has already shown (Proc. U. S. N. M., XXVI, 1903, p. 960).

11. [24] **Cynias manazo** (Bleeker). *Hoshi-zame* = Star-shark.

Sapporo market (Majima); Yokohama and Osaka markets (Jordan); Choshi, (C. Ishikawa); Misaki (Aoki). The species is generally common.

The white spots characteristic of this species vary from being sharply defined to barely traceable. These color variations do not seem to be correlated with any structural differences. The first dorsal fin is above the inner angle of the pectoral fin, as Garman has noted. One specimen from Yokohama market (Jordan *coll.*), C. M. Cat. of Fishes, No. 7774.

Genus MUSTELUS Linck.

The generic name *Mustelus* was independently applied to *Squalus mustelus* Linnæus by several authors: Linck, (1790); Leach, (1812); Fischer, (1813); and Cuvier, (1817). Most early writers, however, failed to notice that the original *Squalus mustelus* was made up of two quite distinct species, later respectively known as *Mustelus lævis* and *Mustelus stellatus*, or *canis*. Linck, however, definitely makes his *Squalus mustelus* identical with *Mustelus lævis*. If we regard the species of this type as divisible into two genera, the name *Mustelus* must stand for the "Smooth Hounds," the *lævis*-type, in which the embryo is connected by a placenta with the uterus. The name *Galeus* Rafinesque must be regarded as a synonym.

12. [25] **Mustelus griseus** Pietschmann. *Inu-zame* = Dog-shark.

Mustelus griseus PIETSCHMANN. Anz. Akad. Wiss. Wien, X, 1908, p. 132; Sitzungsb. Akad. Wiss. Wien, CXVII, 1908, p. 58.

Mikawa Bay (M. Ishikawa); Toyama, Sea of Japan (C. Ishikawa); Tokyo market (Jordan and Snyder, 1900).

This species probably is a true *Mustelus*. It differs widely from *Cynias manazo* in having both the labial folds short, the outer not being extended farther than the inner (or lower) one; the ridge at the symphysis of the mandibular band of teeth more elevated; the postero-ventral caudal lobe lower and more rounded; the dorsal fin more posteriorly inserted, its origin usually being behind the tip of the pectoral; the terminal lobe of the caudal fin in the young is black medially and white above and below, rather than uniformly dusky.

13. [27] **Galeorhinus japanicus** (Müller and Henle).
Yeiraku-fuka = Comfort Shark.

A specimen from Miyazu was presented by Dr. Ishikawa. Others were seen in the Osaka market (Jordan).

The specific name was originally spelled as here given.

14. [29] **Prionace glauca** (Linnæus). *Yoshikiri* = Oriole Shark.

Two young specimens from Misaki are in the Aoki Collection. The species was seen, but not taken, in the markets of Tokyo, Osaka, etc. It is the commonest shark in the markets of Japan. The fins are largely shipped to China, the gelatinous rays making excellent soup. The species needs comparison with the European form.

Family SPHYRNIDÆ.

15. [34] **Sphyrna zygæna** (Linnæus). *Shumoku-zame* = Hammer-shark.

A large embryo from Misaki (Aoki) is at hand. Dr. Jordan found the species common in the markets (Tokyo, Shizuoka, Osaka, etc.) but took no specimens.

Family ALOPIIDÆ.

16. [35] **Alopias vulpinus** (Bonnaterre). *Onaga-zame* = Very long shark.

An embryo from Misaki (Aoki). It is common in the markets (Tokyo, Osaka, etc.). This species, with others from Japan, needs comparison with the Atlantic forms.

The name *vulpinus* of Bonnaterre (1788) is prior to that of *vulpes* (Gmelin, 1789). *Vulpecula marina* of Valmont de Bomare, 1768, adopted by Garman, seems not intended by its author as a scientific name, rather a mere latinization of the French vernacular "*le renard marin.*"

Family MITSUKURINIDÆ.

17. [36] **Mitsukurina owstoni** Jordan. *Tegu-zame*[4] = Goblin-shark; *Zoo-zame* = Elephant-shark.

A specimen of this species from Sagami Bay is in the Museum at Yamada.

Family LAMNIDÆ.

18. [38] **Isurus glaucus** (Müller and Henle). *Ao-zame* = Blue shark.

A large example is in the Yamada Museum.

The posterior insertion of the dorsal, well behind the pectorals, has been used to define the genus *Isuropsis* Gill, but according to Garman the same character is found in *Isurus oxyrhynchus* Rafinesque, the type-species of *Isurus*.

19. [39] **Lamna nasus** (Bonnaterre). *Sake-zame* = Salmon-shark; *Hoshiwani-zame* = Star Alligator-shark.

Jaws in the Yamada Museum, from a shark taken off the coast of Ise, belong to this species, which needs comparison with Atlantic examples. The teeth are long, sharp, and flexuous, with a denticle on each side.

The specific name *nasus* (Bonnaterre) has priority over *cornubica* (Gmelin).

20. [40] **Carcharodon carcharias** (Linnæus). *Oshira-zame* = Great white shark; *Hiragashira-zame* = Flathead-shark.

A young example from the coast of Ise is mounted in the Yamada Museum.

Family CETORHINIDÆ.

21. [41] **Cetorhinus maximus** (Gunner). *Uba-zame* = Nurse-shark.

A young specimen, six feet long, is in the Yamada Museum.

Family PSEUDOTRIAKIDÆ

22. [43] **Pseudotriakis acrages** Jordan and Snyder. *Oshi-zame* = Dumb-shark.

As Garman has noted, the name "*acrales*" given to this species by Jordan and Snyder is a misprint for *acrages* (dumb).

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[4] The demigod, *Tegu* or *Tengu*, is noted for the length of his nose.

Family SQUALIDÆ.

Genus Squalus Linnæus.

Three very distinct species of *Squalus* inhabit the waters of Japan. As they have been greatly confused, and their names variously interchanged, we offer the analyses and synonymies given below.

A Key to the Japanese Species of Squalus.

a. Body conspicuously spotted with white in the young (the spots often becoming obsolescent with age). Pectoral fin shorter, extending not at all, or only at its tip, beyond vertical from dorsal origin. First dorsal spine about midway between tip of snout and end of second dorsal base; ventrals also more posterior in position. Nasal valves less distinctly bilobed . . . (*acanthias*-group).

  b. First dorsal spine less than half the height of fin, shorter than base of fin without spine. Pre-oral length of snout much greater than distance from eye to first gill-slit. Other characters as under *c.* . . . . *Squalus suckleyi.*

aa. Body never spotted, not even in the embryo. Pectoral fin longer, its entire posterior edge being behind vertical from dorsal origin. First dorsal spine midway between tip of snout and second dorsal spine, or still farther forward; ventrals also more anterior in position. Nasal valves distinctly bilobed . . . . (*blainvillei*-group).

  c. Nostrils near middle of pre-oral portion of snout. Snout longer and much more acute terminally; the width of head at mouth about equal to pre-oral length of snout. Posterior angle of pectoral fin scarcely produced and acute, so that the margin of the fin is but weakly concave. Lateral keels of denticles all bent inward to parallel the main keel, so that the scale with age becomes regularly tricarinate. *Squalus mitsukurii.*

  cc. Nostrils much nearer tip of snout than mouth. Snout shorter and blunter at tip; the width of head at mouth much greater than pre-oral length of snout. Posterior angle of pectoral fin notably produced and acute, so that the margin of the fin is rather strongly concave. Lateral keels of denticles often bent abruptly outward, the scale then presenting a cross-like figure . . . . *Squalus brevirostris.*

23. [44 in part] **Squalus suckleyi**[5] (Girard). *Tsimo-gami* = Harbor-shark.

Spinax (*Acanthias*) *suckleyi* Girard, Proc. Acad. Nat. Sci., Phila., VII, 1854 (1856), p. 196 (Fort Steilacoom, Puget Sound).

Acanthias sucklii Girard, U. S. Pac. R. R. Surv., Fishes, X, 1858, p. 368.—Suckley, *ibid.*, Vol. VII, 2, 1860, p. 367.

Squalus sucklii Gill, Proc. Acad. Nat. Sci., Phila., XIV, 1862 (1863), p. 499 (after Girard).—Jordan and Evermann, Bull. U. S. N. M., XLVII, 1, 1896, p. 54 (Aleutian Islands to Santa Barbara).—Jordan and Gilbert, Fur Seal Report, III, 1899, p. 434 (Bering Island).—Evermann and Goldsborough, Bull. Bur. Fish., XXVI, 1906 (1907), p. 228 (Alaskan and British Columbian records).—Starks and Morris, University of California Publ., Zoöl., III, 1907, p. 168 (near San Diego).—Regan, Ann. Mag. Nat. Hist., (8) II, 1908, p. 46 (Pacific Coast of North America southward to California).—Starks, Ann.

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[5] The spelling of the specific name, *suckleyi*, was changed without warrant.

Car. Mus., VII, 1911, p. 207 (Puget Sound).—Garman, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 194 (North Eastern Pacific; exclusive of "variety" *mitsukurii*).—Thompson, Proc. U. S. N. M., L, 1916, p. 420 (San Diego).—Starks, Cal. Fish and Game, III, 1917, p. 152, fig. 62 (from South of Point Concepcion in California to Alaska).—Hubbs, Copeia, No. 43, 1917, p. 37 (Monterey Bay and Santa Catalina Island, California).

Squalus acanthias Jordan and Gilbert, Proc. U. S. N. M., III, 1880 (1881), p. 458 (Puget Sound, San Francisco, Monterey Bay, Santa Barbara).—Jordan and Jouy, *ibid.*, IV, 1881, p. 33 (Santa Barbara to Alaska, especially northward).—Bean, *ibid.*, IV, 1881 (1882), pp. 261, 269, 272, 474 (British Columbian and Alaskan records).—Jordan and Gilbert, Bull. U. S. N. M. ,VI, 1883, p. 16 (in part).—Bean, Proc. U. S. N. M., VI, 1884, p. 361 (Johnston's Straits, British Columbia).—Eigenmann, *ibid.*, XV, 1892, pp. 129, 132 (near San Diego).—Bean and Bean, *ibid.*, XIX, 1896, p. 237 (Commander Islands).—Berg, Pisces Mar. Orient., 1904, p. 287 (records from eastern Asia).—Pavlenko, Kazani, Trd. Obsc. jest., XLII, 1910, p. 11 (records from eastern Asia). (Not of Linnæus.)

Squalus mitsukurii Jordan and Fowler (not "Jordan and Snyder"), Proc. U. S. N. M., XXVI, 1903, p. 629, fig. 3 (Specimen from Aomori, and figure based on this specimen, not the type).—Jordan and Evermann, Bull. Bur. Fish., XXIII, 1903 (1905), p. 45, fig. 6 (figure only, wrongly stated to be "from the type").—Tanaka, Annot. Zool., Jap., VI, 1908, p. 236 (off Korsakoff, Saghalien Id.).—Smith, Proc. U. S. N. M., XLI, 1912, p. 679 (Japan).—Jordan, Tanaka and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 18 (synonymy and range in part, and figure).—Jordan and Metz, Mem. Car. Mus., VI, 1913, p. 4, fig. 2 (figure only).—Tanaka, Fig. Desc. Fishes Japan, XXVI, 1917, p. 471, pl. 130, figs. 368–370 (Watanoha, Province of Rikuzen). (Not *Squalus mitsukurii*, type.)

Squalus wakiyæ Tanaka, Fig. Desc. Fishes Japan, XXVII, 1918, p. 475 (after *Squalus mitsukurii* Tanaka, 1917).

Kushiro (Tanaka); Noo, Mikune, Fukui. We have also at hand the young specimen figured by Jordan and Fowler as *Squalus mitsukurii.* Our five young specimens from Japan are well supplemented by Tanaka's figure and description.

Careful comparison has convinced us of the complete similarity of Japanese and Californian Dog-fishes of the *acanthias*-group. The species is the one originally named *S. suckleyi* by Girard. It is the one figured, but not described or designated as the type, in the first account of *Squalus mitsukurii,* and is the one lately well described, figured, and differentiated from the other forms occurring in Japan by Tanaka.

The White-spotted Dog-fish (the *acanthias*-group) seems to be everywhere restricted to cold or temperate coastal waters, in both the Northern and Southern Hemispheres. *Squalus suckleyi* ranges from the Aleutian and Commander Islands southward to the southern end of California and to the northern part of Japan. Throughout this wide area the range of the species appears to be approximately continuous. The known record-stations are given in the synonymy.

24. [44 in part, and 45] **Squalus mitsukurii** Jordan and Fowler.

Ao-zame = Blue-shark.

Acanthias vulgaris Temminck and Schlegel, Fauna Japonica, Pisces, 1850, p. 304, pl. 135 (Nagasaki?).—Ishikawa, Prel. Cat. Fishes Imp. Mus., 1897, p. 61 (Kagoshima) (*nec* Risso).

Squalus mitsukurii Jordan and Snyder, Annot. Zoöl. Jap., III, 1901, p. 129 (Misaki; a strict *nomen nudum;* locality not uncertain, as stated by Tanaka, 1918.—Jordan and Evermann, Proc. U. S. N. M., XXV, 1903, p. 318 (Misaki; virtually a *nomen nudum*).—Jordan and Fowler (not "Jordan and Snyder"), Proc. U. S. N. M., XXVI, 1903, p. 629 (the type as designated and described, and a part of the paratypes from Misaki, etc. and probably some of the other specimens referred to, but not the specimen from Aomori, which is the one figured, nor most of the Misaki paratypes).—Snyder, Bull. Bur. Fish., XXII, 1902 (1904), p. 515 (Honolulu; Albatross Sta. 4085, Hawaiian Islands).—Jordan and Evermann, *ibid.*, XXIII, 1903 (1905), p. 45 (Kailua, Hawaii; station 4085, after Snyder; not the figure, erroneously stated to be from the type).—Gilbert, *ibid.*, p. 580 (Albatross station 4085, Hawaii).—Regan, Ann. Mag. Nat. Hist., (8) II, 1908, p. 47 (China, Japan, Hawaii).—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 18 (synonymy and range in part, not the figure).—Garman, Mem. Mus. Comp. Zoöl. XXXVI, 1913, p. 195 (as variety of *sucklii*).

Acanthias mitsukurii Günther, Fische der Südsee, Pt. 3, 1910, p. 490 (Japan, Hawaii).

Squalus japonicus Ishikawa, Proc. Acad. Nat. Sci., Phila., LX, 1908, p. 71 (Tokyo market, said to have come from Sagami Bay; Kagoshima, this latter record questioned by Tanaka, 1917).—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 18 (after Ishikawa).—Jordan and Metz, Mem. Car. Mus., VI, 1913, p. 4 (Chinnampo, Korea).—Tanaka, Fig. Desc. Fishes

Japan, XXVI, 1917, p. 467, pl. 130, figs. 365–367 (Tokyo to Atsuta, Owari; ? Nagasaki; ? Rikuzen).

Squalus mitsukurii is the species figured by Schlegel, and the one described, but not the one figured, by Jordan and Fowler; it is identical with *Squalus japonicus* Ishikawa, and not with *Squalus brevirostris* Tanaka, as Tanaka thought in 1918. It is a very common species in southern Japan, and is recorded also from China and Korea. Very similar specimens have been described from the Hawaiian Islands (See synonymy) and these seem to belong to the same species. We have, however, no Hawaiian material at hand.

This species is very similar to the Mediterranean *Squalus blainvillii* Risso,[6] of which we have two examples from Naples, but differs in the shorter pectoral fins and shorter dorsal spines. The material of *S. mitsukurii* at hand comprises only the type, one large and one embryonic paratype.

25. **Squalus brevirostris** Tanaka.

Squalus mitsukurii JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 629 (not the type, but most of the fœtal paratypes from Misaki; not the specimen figured).—JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 18 (in part; after Jordan and Fowler).—TANAKA, Fig. Desc. Fishes Japan, XXVII, 1918, p. 475 (after *Squalus brevirostris* Tanaka, 1917). (Not *Squalus mitsukurii* as determined by the specimen designated as type and described).

Squalus brevirostris TANAKA, Fig. Desc. Fishes Japan, XXVI, 1917, p. 464, pl. 129, figs. 362, 363, and pl. 130, fig. 364 (Japan, probably from Shimonoseki).

A specimen of this species was taken in the Osaka market (Jordan).

Squalus brevirostris is represented among the type specimens of *Squalus mitsukurii* by numerous "cotypes" from Misaki, but not, as Tanaka indicated in 1918, by the type-specimen, designated as such and described by Jordan and Fowler.

Species of the same type as *brevirostris*, and some of them probably identical, occur in Korea,[7] Formosa,[8] the Philippine Islands,[9] Australia,[10] the Juan Fernandez

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[6] See Regan, Ann. Mag. Nat. Hist., (8), II, 1908, p. 47.

[7] *Squalus mitsukurii* Jordan and Metz, Mem. Car. Mus., VI, 1913, p. 4.

[8] *Squalus*, species, Jordan and Evermann, Proc. U. S. N. M., XXV, 1903, p. 318.—*Squalus japonicus* (?) Jordan and Richardson, Mem. Car. Mus., IV, 1909, p. 162.

[9] *Squalus philippinus* Smith and Radcliffe, in Smith, Proc. U.S.N.M., XLI, 1912, p. 677, fig. 1, and pl. 51.

[10] *Acanthias blainvillii* Günther, Cat. Fishes Brit. Mus., VIII, 1870, p. 419 (and some subsequent authors, not of Risso).—*Acanthias megalops* Macleay, Proc. Linn. Soc. N. S. Wales, VI, 1881, (1882), p. 367 (Port Jackson).—*Squalus megalops* Waite, Rec. Austral. Mus., IV, 1901, p. 33, pl. 4, fig. 3 (Neverfail, Australia).—Regan, Ann. Mag. Nat. Hist., (8), II, 1908, p. 47 (South Australia, Tasmania).

Islands off the coast of Chile,[11] Brazil,[12] and Natal.[13] Having no material outside of Japan, however, we do not venture to identify *S. brevirostris* with species from various remote regions.

26. [48] **Centroscymnus owstoni** Garman. *Yume-zame* = Dream Shark.

A male from the market of Shizuoka on Suruga Bay (Jordan) agrees thoroughly with Garman's description and figure.[14] Four young specimens, of both sexes, 27 to 31.5 cm. long, collected by Aoki at Misaki, differ sharply in having the scales everywhere roughly tricarinate, the carinæ being the sculpturing of the flat denticle overlying a rather fleshy, pitted, and pedunculate base. The difference appears to indicate age rather than specific variation. It is probable that with age the denticles become pentacarinate and finally smooth, the change taking place from the caudal region forward toward the head. In our larger specimen the head and front portion of the trunk bear strongly carinate scales, which grade into the smooth pitted scales of the posterior region of the body.

This and other sharks are used at Shizuoka in the manufacture of Kamoboku or fish-curd. The fish are boiled and shredded, mixed with a flour of some sort and pressed into cheese-like cakes. The best grades are formed from Sciænoid fishes (especially *Nibea japonica* and *Nibea schlegeli*), the cheapest from sharks.

Genus DEANIA Jordan and Snyder.

The name *Acanthidium* Lowe (1839) cannot be used for *Deania,* as Garman proposed in 1913, because the first revisers, Jordan and Evermann (1896) restricted *Acanthidium* to the first species named by Lowe, *A. pusillum,* which belongs in the genus *Etmopterus.*

27. [47] **Deania eglantina** Jordan and Snyder.
Hiratsuno-zame = Broad Harbor-shark.

Three specimens, collected at Misaki by Aoki.

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[11] *Spinax fernandezianus* Guichenot, in Gay, Hist. Chile, Zoöl., pt. 2, 1848, p. 365, Isle Fernandez.—*Acanthias fernandezianus* Philippi, An. Univ. Chile, 71, 1887, p. 559, pl. 4, fig. 3.—*Squalus fernandinus* Garman, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 195 (not of Molina; most of synonymy excepted) Isle Fernandez.

[12] *Squalus blainvillii* Ribeiro, Arch. Mus. Rio de Janeiro, XIV, 1907, p. 168 (not of Risso).

[13] *Squalus acutipinnis* Regan, Ann. Natal. Mus., II, 1908, p. 248, pl. 37; Ann. Mag. Nat. Hist., (8) II, 1908, p. 47. (South Africa, Mauritius).

[14] Garman, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 205, pl. 13, figs. 5–8.

28. [53] **Deania rostrata** (Garman).

The front half of a specimen, somewhat larger than the type, was obtained in the Shizuoka market (Jordan). It agrees in detail with Garman's description and figure.[15]

29. [54] **Deania histricosa** (Garman).

A female specimen, 48 cm. long, was collected in the market of Shizuoka, on Suruga Bay (Jordan). It agrees very well in most respects with Garman's description and figure (*l.c.*, p. 220, pl. 11) but differs in having the inner lobe on the anterior nasal valve nearly as large as the outer one.

Genus Dalatias Rafinesque.

The name *Dalatias* Rafinesque (1810) was first restricted by Swainson, who made *D. nocturnus* = *Squalus granulosus* Schneider its type. The name *Dalatias* consequently should apparently supersede *Centrophorus* Müller and Henle (1837). Garman records three species of *Centrophorus* from Japan, which may stand as follows: *Dalatias acus* (Garman); *Dalatias atromarginatus* (Garman); *Dalatias tessellatus* (Garman).

30. [55] **Dalatias acus** (Garman). *Taro-zame.*

In Shizuoka Dr. Jordan saw a large squaloid shark, which probably belonged to this species. It had the dorsal fins low and not falcate, and the color plain gray. Its most striking feature was the bright green eye, which seemed to be alive, staring unblinkingly while the body was being converted into *Kamaboku.*

Family PRISTIOPHORIDÆ.

31. [61] **Pristiophorus japonicus** Günther. *Nokogiri-zame* = Saw-shark.

One specimen was taken in the Osaka market (Jordan).

Fins partly naked; about forty-four rows of teeth in the upper jaw.

Family SQUATINIDÆ.

32. [64] **Squatina japonica** Bleeker. *Kasu-zame* = Change-shark.

One specimen from Mikawa Bay (M. Ishikawa).

Family RHINOBATIDÆ.

Genus Rhinobatos Linck.

The generic name *Rhinobatos* Linck (1790) antedates *Rhinobatus* Bloch and Schneider (1801).

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[15] Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 218, pl. 11, figs. 1–4.

33. [66] **Rhinobatos schlegeli** (Müller and Henle). *Sakata-zame.*

A specimen from Noo, near Niigata on the sea of Japan (Ishikawa). Others were seen in the market at Osaka.

Family TORPEDINIDÆ.

34. [70] **Narke japonica** (Temminck and Schlegel). *Shibere-ei* = Numb-ray.

Misaki (Aoki).

Family PLATYRHINIDÆ.

Genus Platyrhina Müller and Henle.

If the name *Platyrhina* (1838) is regarded as distinct from *Platyrhinus,* the substitute names *Analithis* Gistel (1848) and *Discobatus* Garman (1880) are not needed.

35. [72] **Platyrhina sinensis** (Bloch and Schneider). *Uchiwa-zame* = Fan-shark.

We have a specimen from Mikawa Bay (M. Ishikawa). Another from Sagami Bay was seen in the Yamada Museum.

Family RAJIDÆ.

Genus Raja Linnæus.

Key to the Japanese Species of Raja.

a. Upper parts wholly covered with spinules .... *Raja isotrachys.*[16]

aa. Upper parts mostly, but not wholly, beset with spinules .... *Raja kujiensis.*[17]

aaa. Upper parts largely smooth.

  b. Snout little or moderately produced, its length from eye much less than the distance from spiracle to inner angle of pectoral fin; front margin of disc little concave.

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[16] Günther, Challenger Reports, Deep Sea Fishes, 1887, p. 7, pl. 3.

[17] Allied to *Raja isotrachys* is *Raja kujiensis* Tanaka, Dobutsu-gaku Zasshi, XXVIII, No. 331, May 15, 1916, p. 173. An English translation of the Japanese description has been kindly supplied by Dr. Tanaka:

"Disk rhomboid, wider than long (including ventral fins); snout slightly pointed, its tip making an angle of one hundred and forty degrees; the disk weakly crenulate in anterior margins, rounded at outer angle, making an angle of about one hundred degrees; posterior angles of disk also rounded, making an angle of about ninety degrees; longer diameter of eye shorter than interorbital width; length of snout (measured to front of eye) about two times interorbital width; spiracle shorter than diameter of eye; teeth in each jaw in twenty-five rows; two dorsals well apart. Body uniformly scattered with small spines, the spines very few in a small area behind spiracle, none on the border of eye only; large spines arranged in a single row from behind eye to second dorsal on the middle line of dorsal surface; near centre of disk a pair of rather large spines on either side of the spines of mid-dorsal line; lower surface entirely smooth. Color in formalin purplish brown, with a few black spots, which are scattered irregularly and unsymmetrically in relation to the mid-dorsal line; under surface dead-white, with but few dusky spots; margin dusky gray. Locality: Kuji, in Hitachi, northeast of Tokyo. Length: 825 mm."

c. Snout scarcely produced, its length equal to distance between outer edges of spiracles; line joining extreme angle of pectorals dividing the disc into two equal parts; body covered with black spots. Rostral cartilages united for more than half their length; caudal fin developed; lateral folds on tail conspicuous, extending to middle of caudal fin . . . . *Raja fusca.*

cc. Snout moderately produced, its length much greater than distance between outer edges of spiracles; line joining extreme angles of pectorals dividing the disc into a larger more attenuate anterior part and a smaller posterior portion; body without black spots.

d. Rostral cartilages united for only one-third their length; caudal fin barely evident. Lateral folds of tail very wide, extending almost to extreme tip of tail; tail depressed throughout; first dorsal separated from the second by more than half its basal length; a single row of spines on top of tail in specimens as long as 385 mm.; body unmarked, except for the two pectoral ocelli of the young, and faint lighter spots . . . . *Raja smirnovi.*

dd. Rostral cartilages united for half their length; caudal fin rather high.

e. Lateral folds of tail broad, extending to middle of caudal fin; tail depressed throughout; first dorsal separated from second by less than half its basal length; series of spines on top of tail multiple in specimens as small as 25 cm.; no spines developed on lateral edge of tail; body rather plainly colored, the pale blotches indefinite or absent, even in the young . . . . *Raja tobæ.*

ee. Lateral folds of tail obsolete; tail becoming compressed toward tip, the caudal fin unusually well developed; first dorsal separated from the second by more than half its basal length; series of spines on tail single in specimens as long as 35 cm. (a partial series of spines on each lateral edge of tail in a specimen 58 cm. long); body coarsely and conspicuously blotched with pale, except in large adults. *Raja kenojei.*

bb. Snout greatly produced, its length from eye about equal to distance from spiracle to inner angle of pectoral fin; front margin of disc deeply concave. Rostral cartilages united for about half their length. Caudal fin rather high; lateral folds of tail weak anteriorly, well developed posteriorly, extending to middle of caudal fin; tail depressed throughout; first dorsal separated from second by more than half its basal length; series of spines single on top of tail; adult with a single additional series of spines on each lateral edge of tail; coloration plain . . . . *Raja tengu.*[18]

36. [76] **Raja fusca** Garman. *Kurokasube* = Black Skate.

Raia fusca GARMAN, Proc. U. S. N. M., VIII, 1885, p. 42.—JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 649.—PIETSCHMANN, Sitzungsb. Akad. Wiss. Wien., CXVII, 1908, p. 645.—GARMAN, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 349, pl. 24, figs. 4–5.

Raja kenojei JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1901, p. 337.—JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 652; and of other American writers.—PIETSCHMANN, Sitzungsb. Akad. Wiss. Wien, CXVII, 1908, p. 647. (Not *Raia kenojei* Müller and Henle, nor of other writers prior to 1900).

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[18] Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 654, fig. 8.

This species is obviously not the one called *R. kenojei* by Müller and Henle. We feel fairly certain that the form identified by recent workers as *R. kenojei* is the adult of *Raja fusca*, as we have mature individuals, others half-grown, a young one, and an embryo, well matching Garman's type, all apparently representing stages of growth in one species. The black spots first appear on the pectoral ocellus.

The embryo was collected by S. Yoshizawa at Toyama on the Sea of Japan; the young specimen by Aoki at Misaki; a male 39 cm. long, with small claspers, by Jordan in the Yokohama market.

37. [78] **Raja smirnovi** [19] Soldatov and Pavlenko. *Megane-kasube.*

Raja binoculata SCHMIDT, Pisces Marium Orientalium, 1904, p. 291 (not of Girard, a Californian species).

Raja meerdervoorti SNYDER, Proc. U. S. N. M., XLII, 1912, p. 401 (in part at least; not *Raia meerdervoortii* Bleeker).

Raja smirnovi SOLDATOV and PAVLENKO, Ann. Musée Zoöl., Acad. Imp. Nat. Sci. Petrograd, XX, 1915, p. 162, pl. V, Peter the Great Bay.

Of what seems to be this species we have a young male 385 mm. in total length (C. M. Cat. Fishes No. 7776), taken with a slightly smaller paratype off Fukui on the Japan Sea (Nonaka *coll.*). Six smaller paratypes were collected by S. Takayasu at Takashima, near Otaru. It is doubtless northern in distribution, and is apparently the same as *Raja smirnovi,* lately described from the coast of Siberia. Our material is contrasted with the other Japanese species in the key given above. It is closely related to the Shore-rays of western North America, most closely perhaps to *R. binoculata* and *R. inornata.* From *R. binoculata* it differs in the sharply indented margin of the ventral fin and in coloration, from *R. inornata* in the less widely connected rostral cartilages, in having the second dorsal and caudal fins entirely separated, and in the spination of the back.

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[19] As the original account by the Russian author is not generally accessible, we append the substance of it:

DESCRIPTION OF A NEW SPECIES OF THE FAMILY RAJIDÆ FROM PETER THE GREAT BAY AND FROM THE OKHOTSK SEA.

By V. Soldatov and M. Pavlenko.

Raja smirnovi sp. nov.

Type, a male specimen 1077 mm. long from Peter the Great Bay; cotype, a female specimen 516 mm. long from Okhotsk Sea 58° 38′ N, 152° 45′ E., obtained by Dr. Derbek at depth of 69 fathoms.

Disk much broader than long; the snout broad, not produced at tip. The anterior margin greatly arched; the rostral angle being about 100°. Interorbital area broad, concave. Both upper and lower surfaces are naked; only a few minute spines or prickles present along the anterior and posterior border of pectoral fins, on tip of snout, on anterior and posterior portion of orbital rim. Three strong spines on middle of back in male, and only two in female specimen. Two strong scapular spines in male, as in female. No spines on middle of disk. After interruption the spines reappear in a series of 22–26 on back of tail; a wide band of coarser minute prickles on each side of tail. Under parts without spines and prickles. A wide lateral fold along either side of tail. Pectoral hooks very well developed; they are usually radial in position, in 22–23 series, and have at most 6–7 hooks in a series. Dorsals very high and very near together. Between dorsals there is no spine in the males, and only one in the females. Teeth 20–24. Color in spirits: light brown above, whitish below, no spots or blotches.

Length of body 1077 mm.; width of disk 785 mm.; length of disk 544 mm.; length of snout 136 mm. Named for Mr. Smirnov, Inspector of Fisheries. Collected in the Okhotsk Sea.

Disk broader than long, the greatest width, when measured backward from tip of snout, extending to a point midway between the end of the ventral fin and the insertion of the first dorsal; its posterior margin weakly convex, while the anterior margin is slightly flexuous, a gentle convexity opposite the eyes not quite reaching to the chord across the general convex curve. A straight line between the extreme angles of the disk approximately coincides with the end of the second third of the length of the disk. The front angle of the whole disk is about ninety degrees in the larger specimens, about one hundred degrees in the smaller ones; the angle of the snout, fifty-five degrees in the larger, ninety degrees in the smaller specimens; the snout, as the measurements indicate, becomes produced with age, but the extreme tip is never sharply produced beyond the general contour; the length of the snout from the eye is nearly four times the width of the concave interorbital, about 1.7 times the distance between the outer edges of the spiracles; the length of the snout before the mouth is about 2.4 times the width of the mouth, or the least distance between the nostrils, and is contained 1.6 times in the distance from the mouth to the front of the anal slit. Outer edge of ventral fin sharply indented or deeply concave. Tail short, its length when measured from middle of anal slit only equal to the distance from that point forward to the middle of the pre-oral length of snout; it is much compressed throughout, becoming excessively flat toward its tip. Lateral keel, which originates near the extreme base of the tail, extending backward to within less than 2 mm. of end of tail, leaving a keelless tip scarcely longer than broad; the keel increases in size posteriorly, its dorsal width opposite the second dorsal being equal to the depth of the tail immediately behind that fin. The first dorsal fin is inserted nearer the end of the tail than the anus by a distance equal to its own base, and is separated from the second by an interval nearly equal to its base. Supracaudal extremely low, its height being only one-tenth its length; only separated by a short interspace from the second dorsal. Body wholly smooth, except for a few strong spines, arranged as follows: one at outer edge of front orbital rim, directed outward and backward; one at inner edge of front orbital rim, directed straight backward; one on orbital rim opposite back of eye, directed outward and backward; only one at the shoulder; a row of eight to eleven strictly median spines on the tail, and one or two more between the dorsals. The strong rostral cartilages converge in a slightly convex curve toward the tip of the snout, and are free for two-thirds of their length.

The brown color of the upper surfaces is more or less indefinitely broken by paler blotches. The pectoral ocelli are vividly distinct in our smaller specimens, being reddish, with or without a gray center, within a narrow black ring, but in the larger specimens are rather indefinite. In the young the tail may be transversely banded. The lateral keels of the tail and the extreme front margin of the disk are pale.

As our largest specimen has the claspers barely developed, this ray must attain a large size. Our specimens differ from the original account of this species in the entire absence of small prickles, and in the smaller number of spines on the middle line of the back, both features probably matters of age.

38. [73] **Raja tobæ** Tanaka. *Kasube* = Skate.

Raja meerdervoorti JORDAN and SNYDER, Proc. U. S. N. M., XXXIII, 1901, p. 337. —JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 650, fig. 7, and of subsequent writers, except Pietschmann, 1908, and Snyder, 1912. Probably not *Raia meerdervoortii* Bleeker.

Raja tobœ TANAKA, Zoöl. Mag.*, XXVIII, 1916, p. 313 (in Japanese); Fig. Desc. Fish. Japan, XXV, 1917, pp. 453, 455, pls. 124–127.

Of this species we have a male, very like the type of *R. tobœ*, from Miyazu (Kyoto Fishery Institution); a female, like Tanaka's allotype, from the Tokyo market (Jordan); and six smaller specimens, one from the Toba market (Jordan and Yamamoto), four from Kagoshima Bay (Wakiya), and one from Mikawa Bay (M. Ishikawa).

It seems to us probable that *R. meerdervoortii* of the older authors (prior to 1900) is the same as the original *R. kenojei.* We therefore, adopt Tanaka's name. It is a rather small ray, structurally well distinguished from the others of Japan.

39. [74] **Raja kenojei** Müller and Henle. *Gangiei* = Rasp-skate.

Raia kenojei MÜLLER and HENLE, Plagiostomen, 1838, p. 149, pl. 48, and of other authors prior to 1900.

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*Frequent references made in the synonomy in this paper are to the "Zoöl. Mag." by which is intended the *Dobutzu-Gaku Zasshi*, a Japanese publication issued in Tokyo, of the title of which "Zoölogical Magazine" is a translation. W. J. HOLLAND.

(?) *Raia meerdervoortii* Bleeker, Act. Soc. Sci. Ind. Neerl., VIII, 1860, p. 66.

(?) *Raia japonica* Nyström, Handl. Svensk. Vet. Akad., XIII, 1887, p. 52 (Nagasaki).

Misaki (Aoki); Toyama (Yoshizawa); Miyazu (Kyoto Fish. Instit.). 2 ♀♀.

The name *kenojei* is in current use for a very different species, *Raja fusca* Garman. The name *meerdervoorti*, which is probably synonymous with *kenojei*, has been used for the species lately named *tobæ* by Tanaka. Müller and Henle's figure shows most of the trenchant characters of the present form, thus diverging widely from *Raja fusca*. The species, so far as we can ascertain, has not previously been recorded by American ichthyologists.

Family DASYATIDÆ.

40. [79] **Dasyatis akajei** (Müller and Henle). *Akaei* = Red Ray.

Miyazu, Mikawa Bay.

This species is common in the markets of Japan, especially southward.

41. **Dasyatis ushiei** Jordan and Hubbs, sp. nov. *Ushiei* = Cow-ray.

The type, and only known specimen, (C. M. Cat. Fishes, No. 7778), is a young male, 988 mm. long to tip of tail, collected by Masashi Ishikawa in Mikawa Bay, a branch of the Gulf of Ise.

This Sting-ray is obviously one of very large size, for our type has the claspers still rudimentary. It may be that the adult is the huge form known along the Japanese coasts as "*ushiei*," or "Cow-ray." An example of this *Ushiei*, from the coast of Mutsu, near Aomori, was seen by Dr. Jordan in the Yamada Museum. It was six feet long, had a great sting, and a single row of strong bucklers along the back and tail, but was otherwise apparently smooth; the front margin was rounded, not angular.

The chief characters of the type follow. Disk nearly one-fourth broader than long (the greatest width 383 mm.; the length to opposite end of pectoral 310 mm.). Tip of the snout but slightly produced; the front angle of the snout is 150 degrees; the front angle formed between the nearly straight front margin of the disk is 105 degrees. The line across the greatest width of the disk traverses the anterior part of the disk at a median distance behind the tip of the snout, which is 2.4 times the length of the snout. The ocular and branchial regions are considerably elevated, so that the physiognomy approaches that of the myliobatid rays. Eyes somewhat elevated; orbit about as large as the spiracle, which is of rhombic outline and faces about equally outward, upward, and forward; interorbital flattish, two-thirds as long as the snout. Width of mouth about one-fourth less than least internarial distance, a little less than half pre-oral length of snout, which in turn is one-third distance from mouth to inner posterior angle of ventral fins. Only twenty-three oblique rows of teeth in upper jaw. Oral papillæ seven, in three groups, of which the median series comprises three papillæ. Outer margin of ventral fins longer than either the anterior or posterior sides, slightly concave, and forming an angle of about eighty-five degrees with the posterior margin, which is subtruncate. Tail little more than twice as long as disk; slightly compressed anteriorly, but terete and whip-like behind base of spine. Upper edge of the tail bearing a rudimentary keel shorter than the orbit, located not far behind the base of the spine; lower edge bearing a very low fold, extending from its origin opposite base of spine nearly one-third of distance to tip of tail, where it grades into a low keel, covered with shagreen, which extends almost to the extreme tip of tail. Except for the caudal spine, the body is without armature of any kind, and smooth shagreen is only developed on the posterior three-fourths of tail.

Color of the upper surface gray, with some blackish margins of irregular form and disposition. Tail mostly blackish, white mottled with darker on the lower surface of the thickened basal portion. Under surface of disk white, with darker clouds toward the margin posteriorly.

This species is characterized by its large size, smooth body, the form and keeling of the tail, the numerous (seven) buccal papillæ, the blunt snout, etc.

42. **Dasyatis** species (?).

Another very large sting-ray inhabits the shores of Japan. It has the tail armed with coarse strong tubercles, of very large size on the mid-line before the spine. The lower edge has a strong fold, armed, except anteriorly, with small tubercles, and extending from opposite the base of the caudal spine to, or nearly to, the end of the tail; the upper edge has no keel or fold.

The tail of this species is often sold in the markets of Japan, being made into a cane.

The species apparently is not yet described.

43. [83] **Pteroplatea japonica** Temminck and Schlegel.

Tsuba-kuro-ei = Sword-guard Black Ray.

A specimen from Miyazu was presented by Dr. Ishikawa. Others were seen, but not taken, in the markets of Tokyo, Osaka, etc. It is generally rather common.

44. [84] **Urolophus fuscus** Garman. *Kuro-ei* = Black Sting-ray.

Yokohama market (Jordan); Toba market (Jordan and Yamamoto); Misaki (Aoki); Kagoshima Bay (Wakiya).

Family AËTOBATIDÆ.

45. [85] **Aëtobatus tobijei** (Bleeker). *Tobe-ei* = Hawk-ray.

Tokyo market (Otaki). Not rare southward.

46. **Stoasodon narinari** (Euphrasen).

Tokyo market; a specimen sent by Professor Otaki. This is the first record from Japan of this widely diffused species. Examples from different regions need comparison.

The name *Aëtobatus* was proposed by Blainville in 1816 for the "Raies aigles," of which *Raja aquila* Linnæus was the commonest European and best known species. In his "Faune Française," edited by Serville in 1820, Blainville changed the particle *batus* in each case to *batis* and mentions under *Aëtobatis* but one species, the "*Raie aigle*," which he calls *Aëtobatis aquila*. This species later became the type of *Myliobatis* (Dumeril) Cuvier, 1817. In 1838, Müller and Henle adopted *Myliobatis* for the Eagle-rays, quoting the earlier *Aëtobatis* Blainville as a synonym, while they established a new genus "*Aëtobatis N.*" for the exotic *Raja narinari* Euphrasen. In 1849, Cantor reverted to the original arrangement, making *Myliobatis* a synonym of *Aëtobatis* Blainville, and giving a new name, *Stoasodon*, to *Raja narinari*. It seems to us that this arrangement must stand in accordance with current rules.

Family CHIMÆRIDÆ.

In our opinion the genus *Chimæra* must be subdivided, for the species are distinguished by trenchant structural features. The seven species known to inhabit the waters of Japan may be divided among four genera. These may briefly be contrasted as follows:

a. Claspers trifid.
  b. Anal distinct from the subcaudal; second dorsal fin not notched .... *Chimæra.*
  bb. Anal fin absent.
    c. Dorsal fin not notched .... *Psychichthys.*
    cc. Dorsal fin deeply notched .... *Bathyalopex.*
aa. Claspers bifid; anal fin absent.
    d. Dorsal fin not notched; caudal filament excessively prolonged .... *Phasmichthys.*

Genus Chimæra Linnæus.

Three Japanese species, *C. phantasma*, *owstoni*, and *jordani* may be retained in the genus *Chimæra*, which otherwise will include only *C. monstrosa* of the Atlantic Ocean.

47. [87] **Chimæra phantasma** Jordan and Snyder. *Gin-zame* = Silver shark.

An adult female from the Osaka market (Jordan) corresponds well with the descriptions of this species given by Jordan and Snyder, by Tanaka, and by Garman. A mounted skin from Sagami Bay was seen in the Yamada Museum.

Genus PSYCHICHTHYS Fowler.[20]

We provisionally adopt this name for Chimærids having trifid claspers, anal fin absent, and the dorsal fin not notched. In addition to the new species described below *Psychichthys ogilbyi* has been listed from Japan, a record which needs verification.

48. [89] **Psychichthys eidolon** Jordan and Hubbs, sp. nov. (Plate V, fig. 1.)

Kachi-zame = Priceless shark.

Chimæra purpurascens (Gilbert MS.) JORDAN and SNYDER, Smiths. Misc. Coll., XLV, 1904, p. 235.—TANAKA, Jour. Coll. Sci., Tokyo, XX, Dec. 1905, p. 14. Not *C. purpurascens* Gilbert, Bull. U. S. Fish. Comm., XXIII, 1903 (Aug. 1905), p. 582, fig. 231, which is a Hawaiian species.

Type, a specimen 128.5 cm. long, from "off Mishima, Izu, in Sagami Bay"; Cat. No. 12902, Stanford University Fish Collection. (C. M. Cat. Fishes, No.7779).

Jordan and Snyder recorded the same specimen in 1904, referring it to a Hawaiian species described in a manuscript by Dr. Gilbert, which did not appear until some time later. As the account given by Jordan and Snyder was not intended as a description, but merely as an indication that a black chimæra occurred also in Japan, the name *purpurascens*, dating from 1904, must be regarded as *nomen nudum*, until the appearance of the paper by Gilbert. Tanaka gave a brief account of the species as *Chimæra purpurascens* in his descriptions of *Chimæra jordani* and *C. owstoni*. Garman[21] for no apparent reason uses this name to replace *C. jordani*, a Japanese species unknown to Jordan, Snyder, or Gilbert, and then renames the true *C. purpurascens*, as *Chimæra gilberti*.

Psychichthys eidolon is most like *P. purpurascens*, the Hawaiian species, with which it has been confused, but differs in the much higher first dorsal fin and much shorter pectoral fin, so that the spine is contained much less, instead of much more, than two times in the length of the upper pectoral margin. The soft dorsal rays are higher than in *purpurascens*, 4.5 in head.

Body moderately deep (depth a little less than one-sixth the total length), and compressed throughout. Head massive, almost as deep (although only half as wide) as long. Snout produced as a conic projection about as long as eye, and with its base separated from the nostrils by a like distance; tip of snout on level with lower border of eye. Interorbital space convex, a little narrower than the eye is long. Anterior dental laminæ of the upper jaw contain five or seven enamel rods; anterior laminæ of lower jaw notched at symphysis. Eye, 4.2 in head; orbit, 3.35; interorbital, 4.4; snout, 1.8; pre-oral length of snout, 2.4; distance from snout to isthmus, 1.95; least distance from eye to gill-slit, 2.35, barely greater than least distance from eye to suborbital fold; eye to insertion of dorsal spine, 1.9. Dorsal spine comparatively slender, without anterior keel, posterolateral serrations, or posterior groove, and contained about 1.3 times in head. Soft portion of fin extending as a rounded tip adjacent to the spine; slightly farther outward it has a margin, which is straight, except toward the base, where it is bent sharply backward to merge into the low keel, which, enclosed in a fleshy groove, connects the two dorsals. First dorsal inserted nearly the length of an eye behind vertical from end of head; second dorsal farther backward, a distance equal to length of head minus eye. Second dorsal rising gradually to attain its full height (4.5 in head) above middle of the depressed ventral fin; then maintaining this height almost to its end. The short interval between second dorsal and caudal is filled by a fleshy ridge, which merges into the latter fin. Supracaudal rising to its greatest height near end of first third of length of its base, which equals the interval between origins of the two dorsals; it is separated slightly by a notch from a very low fleshy keel, which extends farther backward about half length of eye. Subcaudal similar in shape and height to supracaudal, but its rayed portion extends farther in each direction, its base being about one-fourth longer; it is continued without notches backward as an inconspicuous dermal fold well toward the end of the caudal filament, and forward indefinitely as a thick fold. Pectoral fin less than length of eye longer than head, and, when depressed, does not reach the ventral; its edge is very slightly falcate dorsally, but continued around in a wide circle to a distinct notch at the lower posterior end of the base. Caudal filament at least as long as the snout, as measured from the end of the rayed portion of dorsal. The tip of the tail is imperfect, and may have been broken off, but it was probably little, if any, longer.

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[20] Fowler, Proc. Acad. Nat. Sci. Phila., 1907, p. 419.

[21] Garman, Mem. Mus. Comp. Zoöl., XL, 1911, p. 86.

Color a uniform deep purplish black, as dark on the belly as on the back. The tone of color, and particularly the absence of counter-shading, indicates that the species inhabits waters of great depth. Its Hawaiian representative, *Psychichthys purpurascens*, was taken at a depth of between 957 and 1067 fathoms.

Genus BATHYALOPEX Collett.

49. [93] **Bathyalopex barbouri** (Garman). *Hoshi-ginzame* = Star Chimæra.

Chimæra spilota TANAKA, Jour. Coll. Sci. Imp. Univ., Tokyo, XXIII, 1908, p. 15.

We have not seen this species.

Genus PHASMICHTHYS Jordan and Hubbs, gen. nov.

Genotype: *Chimæra mitsukurii* JORDAN and SNYDER.

This genus differs from *Hydrolagus* (*colliei*) of the California coast (with which it agrees in having the claspers bifid and having no distinct anal fin) in the lack of a notch in the second dorsal and in the great prolongation of the caudal filament.

Apparently *Chimæra novæ-zealandiæ* Fowler should be referred to this genus.

50. [88] **Phasmichthys mitsukurii** (Jordan and Snyder).

Chimæra phantasma JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 669 (not of Jordan and Snyder).

Chimæra mitsukurii (Dean MS.) JORDAN and SNYDER, Proc. U. S. N. M., XXVII, January 23, 1904, p. 224, fig. 2, Sagami Bay.—DEAN, Jour. Coll. Sci. Tokyo, XIX, February 15, 1904, p. 6, pl. 1, figs. 1, 2, Sagami Bay.—GARMAN, Mem. Mus. Comp. Zoöl., XL, 1911, p. 87.

A male from Misaki (Aoki).

Garman erroneously describes the claspers as trifid in this species.

Jordan and Snyder's description has slight priority over that of Dean, but the name being taken from Dean's manuscript we must attribute the species to Dean.

Family PTEROTHRISSIDÆ.

51. [99] **Pterothrissus gissu** Hilgendorf. *Gisu.*

Shizuoka and Yokohama markets (Jordan).

This peculiar fish is common in rather deep water from the vicinity of Tokyo southward. At Shizuoka great numbers are used in the manufacture of *kamoboku*, producing a grade little inferior to that made from the sciænoid fishes.

Family ELOPIDÆ.

52. [101] **Elops machnata** Forskål. *Kara-iwashi* = Whole Sardine.

Misaki (Aoki); Kobe market (Jordan).

The *Elops* of Japan and Formosa has been referred by Jordan and Richardson,[22] Tanaka,[23] and Jordan, Tanaka, and Snyder[24] to the Hawaiian species, *E. hawaiensis*, rather than to the East Indian species, *E. machnata*, with which Regan[25] included it in his review of the genus. We have compared our three Japanese specimens with two from Hawaii, the latter representing *E. hawaiensis*. The two forms were found to be extremely similar, the character of the projection of the lower jaw, emphasized by Regan in his key, being identical. This character, however, seems to have no specific value. Slight differences appear in the number of fin-rays: the Japanese specimens having twenty-three to twenty-five dorsal rays (sixteen to nineteen branched), and fifteen to seventeen anal rays (eleven or twelve branched); while the Hawaiian representatives have twenty-five to twenty-seven dorsal rays (twenty to twenty-one branched), and fifteen to seventeen anal rays (eleven to thirteen branched). A greater difference seems to exist in the number of vertebræ, sixty-four in one from Japan, sixty-eight in each from Hawaii. The Japanese specimens furthermore have the head slightly shorter, the eye smaller and the interorbital a little broader than in those from Hawaii. As Regan describes like differences in his accounts of the two species, we return to his view that the *Elops* of Japan and neighboring regions is referable to the East Indian *E. machnata*, rather than to the Hawaiian species. A comparison of larger series, however, is still to be desired.

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[22] Mem. Car. Mus., IV, 1909, p. 165, pl. 66, upper fig.

[23] Fig. Desc. Fishes Japan, X, 1912, p. 184, pl. 50.

[24] Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 35.

[25] Ann. Mag. Nat. Hist., (8) III, 1909, pp. 37–40.

Family DOROSOMIDÆ.

Genus CLUPANODON Lacépède.

In accordance with the rules of the International Commission the name *Clupanodon* Lacépède is restricted to *Clupea thrissa* Osbeck, thus replacing *Konosirus*.

53. [103] **Clupanodon punctatus** (Temminck and Schlegel). *Konoshiro*, name of a dungeon-castle, in allusion to the black cross-streaks.

Misaki (Aoki); Mikawa Bay (M. Ishikawa); Kagoshima Bay (Wakiya); Fukui (K. Nonaka); Miyazu, Tokyo, and Kyoto markets (Jordan). (C. M. Cat. Fishes, No. 7780, a–b.)

This species is very common along shore, and is to be found in every market. It is subject to some variation in coloration; the lines of black spots and the black scapular blotch, although usually very distinct, being sometimes faint or obsolete.

Family DUSSUMIERIIDÆ.

54. [105] **Etrumeus micropus** (Temminck and Schlegel).
Urume-iwashi = Market Sardine.

Misaki (Aoki); Tokyo market (Jordan). Toba (Jordan and Yamamoto); Osaka, Kobe, Choshi.

This species is inordinately abundant along the whole coast of eastern Japan, the commonest of the various fishes known as "iwashi" (sardine). It is dried by the ton.

55. [106] **Spratelloides japonicus** (Houttuyn). *Kibuna-iwashi.*

Tatoku Island, off Toba (K. Mikimoto).

This little herring, known by its brilliantly silvery lateral stripe, swarms off the coast of Kyūsyū.

It does not seem necessary, for reasons given elsewhere, to regard *Atherina japonica* Houttuyn as the type of the genus *Stolephorus* Lacépède.

Family CLUPEIDÆ.

56. [107] **Sardinia melanosticta** (Temminck and Schlegel).
Iwashi = Sardine; *Ma-iwashi* = True Sardine.

Misaki (Aoki); Mikawa Bay (M. Ishikawa); Nagoya and Tokyo markets (Jordan); Toba market (Jordan and Yamamoto); Kushiro (Tanaka); Takashima, western Hokkaido (Takayasu).

This species is a true sardine, or *Sardinia*, much like *Sardinia pilchardus* of Europe.

57. [109] **Ilisha elongata** (Bennett). *Hira* = Broad.

Osaka market (Jordan); Fukuoka (Hamada).

The little fish from Korea, known as *Zunasia chinensis* (Basilewsky), seems to be the young of this species.

58. [110] **Clupea pallasii** Cuvier and Valenciennes. *Nishin.*

Kushiro (Tanaka). Hakodate.

The Pacific Herring is excessively common along the shores of the Hokkaido, forming the object of large fisheries.

59. [111] **Harengula zunasi** (Bleeker). *Zunashi.*

Tokyo and Shizuoka markets (Jordan); Kagoshima Bay (Wakiya); Mikawa Bay (M. Ishikawa); Fukuoka (Hamada); Fukui (Nonaka); Misaki (Aoki).

Generally abundant southward.

Family ENGRAULIDÆ.

60. [112] **Engraulis japonicus** (Temminck and Schlegel). *Katakuchi* = Wide-mouth.

Misaki (Aoki); Tokyo market (Jordan); Toba market (Jordan and Yamamoto); Tatoku Island (K. Mikimoto); Fukui (Nonaka). Specimens from Soo-chow, China have also been examined by us, the first to be recorded from that country.

61. [113A] **Coilia ectenes** Jordan and Seale. *Etsu* = Jolly.

An adult specimen from near Fukuoka on the west coast of Kyūsyū seems to be referable to this Chinese species, rather than to *Coilia nasus** of the eastern shores of Japan. From the same locality we have received the Chinese *Nibea albiflora* replacing the Japanese *N. mitsukurii.* This general region no doubt contains a considerable intrusion from the Chinese fauna.

Pectoral filaments, 6; dorsal rays, 1–3–10; anal rays, 95; transverse scale-rows, about 80; scale-rows before dorsal, about 18. Eye and snout together a little less than half the postorbital length of the head.

We have also examined a paratype of the species from Shanghai, several from Soo-chow, and a series from Port Arthur. We count the anal rays as 95 to 108, Jordan and Herre counted 100 to 113, while Jordan and Seale gave 123 for the type.

Family SALMONIDÆ

By David Starr Jordan and Ernest Alexander McGregor.

Genus Oncorhynchus Suckley.

In the north of Japan, especially around the island of Hokkaido, the Pacific salmon occur in great abundance, entering the rivers from the sea to spawn, their habits being identical with those of the species on the American coast from Alaska to California. So far as known, the species of Northern Japan are identical with those of the Northern and Eastern Pacific.

In Southern Japan, where the sea-water is much warmer, the salmon and charr do not appear to enter the sea, the several species being land-locked in mountain-lakes or confined to mountain-streams. As this condition has existed undoubtedly for a long time, certain forms have come to be distinguishable from their presumable ancestry as recognizable species. These forms are more or less dwarfed and the maturing ages of individuals, as revealed through study of the scales, are always greater than those of their parent species of similar size. The younger individuals exhibit in the brooks the habits of trout and are known by the Japanese as *Yamame,* the adults as *Masu.* It is of interest to note that these land-locked forms have undergone certain modifications in their anatomical characters analogous to those of the true trout of the subgenus *Trutta*. The increased number of vertebræ (63 to 70) is retained, however. None of the trout have more than sixty-two, so far as known. A final test is seen in the development of the hooked nose in the ripe males (at least in the case of *O. adonis* and *O. rhodurus*), and in the production of but one generation of ova and spermatozoa. The latter characteristic obviously implies the death of the individuals after once spawning, as in the marine species of *Oncorhynchus*. This condition has not been demonstrated in *Oncorhynchus ishikawæ* nor in *O. macrostomus*, the southernmost form of Japan, both probably derivatives of *Oncorhynchus Kisutch*.

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*Note: According to Rendahl the Japanese species, *Coilia nasus* Temminck & Schlegel, is not separable from *Coilia clupeoides* Lacépède of the Chinese coasts.

According to Dr. Einar Lönnberg (Svensk. Akad. Vid. XXII), who has examined the Linnaean types, the original *Clupea mystus* L. (which became *Mystus clupeoides* of Lacépède), is the Chinese species, *Coilia grayi* Richardson.

The common Japanese and Chinese species retains the name *Coilia nasus* (Schlegel). *Coilia clupeoides* Günther (not Lacépède) is probably the same. The name *Coilia clupeoides* should give place to *Coilia mystus.* D. S. Jordan.

KEY TO THE SPECIES OF ONCORHYNCHUS.

Subgenus HYPSIFARIO.

a. Gill-rakers comparatively long and numerous, 30 to 40 in number; scales relatively large, 126 to 133, of which the structural characters are as follows: circuli typically terminating abruptly in reticulations, which form a zone usually extending broadly along radial border of exposed area to near margin of scale; exposed surface comparatively free of concentric or other markings.

  b. Marine form. Vertebræ 64; pyloric cœca 75–95; branchiostegals 13–15; anal rays 14–16; gill-rakers about 37; scales about 130; vertebræ 64. Color bright clear blue above, silvery below; lower fins pale; upper fins dusky; young with obscure round black spots above, which fade with age, often distinct on caudal fin; spawning males blood-red, the shading irregular . . . . *nerka.*

  bb. Dwarf land-locked forms; vertebræ 66 to 69; pyloric cœca 51 to 69; anal rays 13 or 14; branchiostegals 12; gill-rakers about 32.

    c. Form lanceolate, symmetrical dorsal fin set posteriorly; caudal peduncle slender, 3 in head; scales 134; maxillary 1.66 in head. Color silvery; male with a narrow bright red stripe along side; no black or red spots; dorsal and pectoral fins pale, sharply and narrowly edged with black . . . . *adonis.*

    cc. Moderately elongate; dorsal relatively anterior; gill-rakers 39 to 41; pyloric cœca 51 to 59. Sooty blackish, no stripes or spots on adult males, no red on sides. *kawamuræ.*

Subgenus ONCORHYNCHUS.

aa. Gill-rakers comparatively short and few, 19 to 30 in number; scales often smaller, 130 to 215, the circuli not terminating abruptly in the reticulations, when present.

  d. Scales very small, 185 to 215, circuli continuing through the reticulated zone; nuclear rings coarse; rarely with more than one annulus; branchiostegals 11 to 12; gill-rakers 20 to 30; pyloric cœca 180 to 217. Color bluish silvery below; hind part of back and adipose fin with many black spots; caudal fin with conspicuous black, more or less oblong, spots; males blotched with red; becoming excessively distorted, the shoulder conspicuously humped at maturity; size small; flesh pale, with little flavor . . . . *gorbuscha.*

    dd. Scales medium, about 130 to 145.

      e. Anal rays 13 to 15; branchiostegals 13 or 14; gill-rakers 20 to 25; pyloric cœca 111 to 150; circuli of scales typically traceable part way through the reticulated zone, which is narrow and rarely extends beyond second year's growth; radiating scallopings commonly on exposed area; scale often broadest on transverse axis; nuclear circuli coarse; mature scale with two or three annuli. Color dull silvery; black spots small or obsolete; fins dusky; the adult male blotched or barred with darker, often brick-red; flesh pale and rather soft. . *keta.*

ee. Anal rays 14 to 17; branchiostegals 13 to 18; gill-rakers 22 to 29; pyloric cœca 90 to 214; vertebræ 62 to 68; circuli of scales typically not continuing on exposed area (certain races may have a very few circuli present on exposed area); annuli often traceable on exposed surface. Back and upper fins with many small roundish black spots; silvery becoming dusky at spawning time; largest in size of the salmon; usually with red flesh . . . .*tschawytscha.*

ddd. Scales rather large, 120 to 139; circuli not breaking up into reticulations at border of exposed surface, and at least seven or eight (usually many) of them continuing around on exposed area, even in older individuals; outline of scale typically longest on antero-posterior axis; pyloric cœca relatively few, 50 to 81; gill-rakers 19 to 25; anal rays 13 to 15; branchiostegals 12 to 15.

f. Marine forms.

g. Color silvery with few or no dark spots above; no red spots; parr marks not persistent; breeding males dull red; no red on caudal fin; dorsal fin more or less dusky above; caudal deeply forked, the lobes acute; length often twenty-five inches or more . . . .*kisutch.*

ff. River and lake-forms.

h. More or less dwarfish; color various; the caudal in life more or less edged above and below with red.

i. Scales with few (some to ten) circuli continuous around the exposed area; sides with more or less persistent round dark parr marks; black spots on sides often intermingled with crimson spots; sides below lateral line variously spotted; one to usually fifteen larger spots in a series along side; dorsal and caudal with few or no spots.

j. Dorsal fin above jet-black, this color rarely fading in spirits, a pale area below and one behind the black; adipose fin mostly pale; caudal fin deeply forked, lobes acute, its edge dusky; anal rays 12 or 13 (rarely 11); gill-rakers 18 to 20 (rarely 21); pyloric cœca 40 to 60; scales 125 to 135, approximately the type of those of the Silver Salmon, *O. kisutch*; circuli invading the exposed area, revealing much greater age than in equal-sized scales of *O. kisutch*; no spawning marks. *ishikawæ.*

jj. Dorsal fin without black above, more or less abruptly pale at tip, immaculate, or with a few small round inky spots along basal line, usually four in number (often six or eight, or only two, or wanting); no black spot below first ray; tips of anal and ventrals creamy white; anal relatively low and small; adipose fin dark-edged, but without distinct spots, blacker in front at base; sides of body more or less spotted, usually with a row of rather large spots along side of belly, often duplicated; caudal lunate, with bluntish lobes; anal rays 12 or 13; branchiostegals, 11 to 14; scales 120 to 140, structurally resembling those of the Silver Salmon, *O. kisutch,* but of greater age than the scales of equal size in *O. kisutch.* Dwarfish, not migratory, so far as known. . *macrostomus.*

ii. Scales with many (21 to 31) continuous circuli on the exposed area; dorsal fin not black above, with inky spots at base, those on the fin rather numerous, mostly oblong, narrow, and set obliquely; a dark spot at base of first ray; caudal with no, or numerous spots, which are elliptical and parallel with the rays; the upper and especially the lower ray of caudal bright red in life; back and sides with numerous round or oblong spots, no red spots; tips of dorsal, ventrals, and anal pale; adipose fin with a dark spot. Spawning male with the head black, the jaws much distorted, and the maxillary very long. Anal rays 12 or 13; branchiostegals 12 or 13; vertebræ 63 (rarely 64); scales 127 to 133, approaching the type of those of the Silver Salmon, *O. kisutch,* but with traces of reticulations (in a four-year old specimen, twenty inches long); gill-rakers very short, 18 to 20; pyloric cœca 42 to 57; size relatively large. . . . . *rhodurus.*

Subgenus *Hypsifario* Gill.

62. [118] **Oncorhynchus nerka** (Walbaum).

Beni-masu = Red Salmon.

The Red Salmon of the North Pacific (Sock-eye, Blue-back, *Krasnaya Ryba*) is not yet definitely known from Japan by typical examples, although abundant in the Commander Islands and apparently in Kamchatka. It only enters rivers having lakes at the head-waters, spawning in the streams above the lake, and spending from one to three years in the lake. In certain lakes of Japan, however, Lake Akan in Kushiro, Lake Tozama in Ugo, and Lake Hakone in Sagami, specialized derivatives of this species occur, two of which may be regarded as distinct species.

Oncorhynchus nerka is subject to considerable variation, the races of the different rivers of the North possessing distinctive marks recognizable by experts, though not available for specific distinction. In general the gill-rakers vary in number from 30 to 40; the pyloric cœca from 75 to 95; the branchiostegals from 13 to 15; the anal rays from 14 to 16. The scales are about 130.

The structure of the individual scale of each species of salmon appears to be sufficiently characteristic to make it worth while to incorporate a description of each into the specific diagnosis.

Scale of typical *O. nerka*: Circuli nearly always terminating abruptly in reticulations along the radial border of exposed surface, which forms a zone usually extending broadly to or near to margin of scale. Typically only three to five unbroken circuli invade the exposed area. Rudiments of annuli are at times traceable around exposed area, but more often the latter presents a blank record.

The dwarfed land-locked form in certain lakes of the State of Washington, known as subspecies "*kennerlyi*," differ from the ordinary *O. nerka* in their small size (rarely over a foot in length), the body perhaps more compressed and the black spots on the back usually more distinct, extending upon the upper rays of the caudal and continuing over the whole caudal fin. The "*kennerlyi*" or dwarf form is probably ontogenetic, not to be noted in taxonomy, although, according to Dr. Gilbert, individuals artificially confined, become mature and spawn when very small.

Two examples from Lake Akan in Kushiro, noted by Jordan and Snyder (See Proc. U. S. N. M., XXIV, 1902 (1904) p. 576) and preserved in the Stanford Museum, have anal rays 15; branchiostegals 14; gill-rakers 19+22=41; scales 130. Color pale, with few dark spots sparsely set on back, base of dorsal and upper rays of caudal (entirely wanting in one specimen), pectorals, and ventrals very dark above, paler on lower side.

A specimen, No. 1928, from Kushiro (Tanaka), more resembles the type of *O. adonis*, differing in the much more diffuse dark edging of the pectoral fins, the much larger number of pyloric cœca, slightly more numerous gill-rakers, and it also shows the following characters: length 11.31 inches; anal rays 17; branchiostegals 12 to 13; gill-rakers 14+20=34; pyloric cœca 91; vertebræ 60+6=66+u; scales 133, which structurally show three circuli invading the exposed area; reticulations present; annuli three (just completed third year). Body rather deep, compressed, the back elevated. Color rather dark, sides silvery, with no trace of red stripe; small black spots along the back and on the upper rays of caudal. Dorsal lighter toward base and tip, four or five distinct black spots at base. Pectoral with a broad dusky margin. Adipose fin pale, with a dark spot; caudal pale, with a few spots on upper rays. Peritoneum pale slaty-gray, with darker rib-stripes, but no stippling. This specimen must be referred to *O. nerka*, having a like number of pyloric cœca. It may not be land-locked.

63. [118A] **Oncorhynchus adonis** Jordan and McGregor, sp. nov.

(Plate V, fig. 2; Plate VIII, fig. 4, scale.)

Of this species but two examples were taken, a ripening male, 12.94 inches long, Collector's No. 2190 (type), Car. Mus. Cat. of Fishes, No. 7784, collected by Doctor Jordan in Lake Hakone in Sagami in late October, and a ripe male 8 inches long (I. W. No. 107) taken by Mr. T. Ota in Lake Kizaki at the head of the Hime River near Nagano in Shinshu.

Form of body gracefully elliptical, slender in head and tail and more evenly symmetrical than in other salmon, thus contrasting strongly with the chunky *O. rhodurus* of the same waters. Dorsal fin set posteriorly. Head fully four times in length to base of caudal; depth of body about four times in length; caudal peduncle three in head; eye six in head; snout 3.33 in head; maxillary 1.8; pectoral 1.2 in head; branchiostegals 12–12 to 11–13; anal rays 13; dorsal rays 10; gill-rakers 13 or 14, plus 18 or 19=31 or 33; pyloric cœca 67 to 69; vomerine teeth small, about five in a long and narrow series; two rows, each of four or five teeth, on tongue, which is wide and slaty; peritoneum whitish, unspotted; vertebræ 61+5=66+U.[26] Scales 131 to 134, structurally somewhat intermediate between those of the Sock-eye and Silver Salmon. About five circuli invade the exposed area, where they are much more widely spaced than on the concealed area, making the focus excentric; three annuli present in the fourth year, a very limited amount of reticulation exhibited; scales of lateral line conspicuously acute; circuli of nucleus widening toward focus (possibly a five-year old fish, if it is a two-year nucleus).

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[26] This formula for presenting the vertebral count will be followed in this treatment of the Salmonids and is explainable as follows: The larger (first) number refers to those vertebræ not involved in the caudal support; the smaller (second) number represents the number of vertebræ from which arise the widened caudal, neural, and hæmal plates; "U" stands for the urostyle.

The type (Coll. No. 2190, Car. Mus. Cat. Fishes, No. 7784) caught in October, 1922, is beginning to appear hook-nosed. It was in life everywhere silvery; the head light yellowish-green; a conspicuous straight narrow band of bright light crimson along sides; back greenish, with many small round black spots; base of dorsal with four or five spots; caudal much spotted, some of the spots oblong; anal with faint spots; sides unspotted; fins all abruptly and narrowly edged with jet-black, as though the color had been inked on; this marking especially distinct on the pale pectorals; no red spots; no red on fins; no black nor pale tip to anal or dorsal; a few small spots on bases of dorsal and caudal. In spirits the characteristic red stripe disappears, leaving a white space.

An example, taken by T. Ota from Lake Kizaki in Shinshu (I. W. No. 407), belongs also to the group of allies or derivatives of *H. nerka* and probably to *H. adonis.* Its anatomical characteristics have been incorporated with those of No. 2190 in the foregoing analysis. Length eight inches. Body symmetrical, as in the type of *H. adonis.* Back with small dark spots, extending on upper rays of caudal. No red markings (in spirits). Fins dusky, not evidently edged with darker. The example is a ripe male, although dwarfish.

64. [118B] **Oncorhynchus kawamuræ** Jordan and McGregor, sp. nov.

Kunimasu = Local Salmon. (Plate V, fig. 3; Plate VIII, fig. 5, scale.)

This species, another land-locked derivative of *O. nerka* is based on three examples, No. 1836 (type C. M. Cat. Fishes, No. 7785), No. 455, and No. 466, all ripe males from Lake Toyama in the mountainous western part of Ugo in the northwestern part of Hondo, presented by Professor Tamiji Kawamura. It is reputed to live at a considerable depth, coming to shallow water to spawn. The specimen, Collector's No. 466, shows the following characteristics: length 12 inches; head 4 times in length; depth barely over 4 in length; eye 7.5 in head; snout 2.9; maxillary 1.7; pectoral 1.33. Anal rays 14; dorsal rays 11; branchiostegals 12–12; gill-rakers 17+24=41; pyloric cœca 51; vomerine teeth 4 to 10 in a zigzag series; scales to end of vertebræ 126, structurally showing four or five circuli invading exposed area, badly absorbed, but at least in fourth year. Color dark blue, not silvery, almost black; no dark spots on body or fins; fins dark, tipped obscurely with black and black-edged.

The paratype, Collector's No. 455, and the type, No. 1836, are entirely similar, except that in the former the branchiostegals are 11–12; the scales 130; gill-rakers 15+24=39. In the type specimen the branchiostegals are 12–11; the scales 134; gill-rakers 17+23=40; and pyloric cœca 59. Of the two specimens (Coll. Nos. 455 and 1836) the former had the scales deeply imbedded, which prevented their study; but the latter clearly was in its fifth year with a two-year nucleus. All the specimens are ripe males, but not hook-nosed.

This form differs from the land-locked variants of *Oncorhynchus nerka* chiefly in the dark color, the lack of spots, the smaller number of branchiostegals, and especially of pyloric cœca, as well as in the scale-structure, which shows almost no reticulation.

Subgenus *Oncorhynchus*.

65. [123] **Oncorhynchus gorbuscha** (Walbaum). *Karafuto-masu* = Saghalin Salmon; *Koon-masu*. (Plate VIII, fig. 3, scale.)

This species occurs in the northern Hokkaido, where it is commonly salted with the Sake, *O. keta*. We have one specimen from the Hokkaido, found in the market of Shizuoka.

It may be known by its very small scales (usually about 200); its small size; and especially by the large, mostly oblong, spots, which mark the caudal fin. The ripe male is characterized by a conspicuous hump above the shoulders so that the depth of the body frequently exceeds one-fourth its total length. The scale-structure shows circuli breaking up into reticulations along the radial border of the exposed surface, and visibly continuing through the reticulations; nuclear circuli coarse; rarely with over one annulus.

Our example (Collector's No. 2184) is a mature male. Length: 18.125 inches. Color: slaty-blue above lateral line, not darker on back; dorsal fin dusky especially at apex; adipose fin large, pale; no spots, except those on caudal, which are large and elongate; sides below lateral line and belly pale; pectorals and ventrals dusky above, the former with a wide distal darkish border; anal fin with a similar border. Anal rays 14; gill-rakers 14+18=32; branchiostegals 11–12; pyloric cœca (missing); scales 185, structurally resembling the scales of the typical Humpback, *O. gorbuscha*, except that the second annulus is present at the margin (much absorbed, hence at least in its second year).

66. [124] **Oncorhynchus keta** (Walbaum). *Sake*.
(Plate VIII, fig. 11, scale).

Salmo keta vel kayko Walbaum, Artedi, Piscium, 1792, 72. Rivers of Kamchatka. After the *Keta* or *Kayko* of Pennant and Krascheninnikow.

Oncorhynchus keta Jordan and Snyder, Proc. U. S. N. M., XXIV, 1902, p. 572. (With detailed synonymy.)

Salmo masou Brevoort, Exp. Japan, 1856, pl. IX, fig. 2, (name on a very bad drawing, changed in the text to *Salmo orientalis* Pallas, p. 275: Hakodate.

? *Oncorhynchus masou* Jordan and Snyder, Proc. U. S. N. M., XXIV, p. 571. (Specimen from Aomori; scales 190; A. 15; B. 13; gill-rakers 12+17=29. Color: blackish, unspotted.)

Oncorhynchus haberi Hilgendorf, Monatsber. Ges. Ost-Asien, XI, 1876, p. 25. A. 16 to 18; B. 13–15; scales 136 to 150. Hokkaido, common in markets.

? *Oncorhynchus yessoënsis* Hilgendorf, Monatsber. Ges. Ost-Asien, XI, 1876, p. 25, Hokkaido. A. 16 or 17; B. 13–14; scales 133 to 137; cœca 132 to 161; vertebræ 68.

This is the common large salmon of Japan, everywhere known as "Sake" or "Shake," exceedingly abundant in the Hokkaido, extending its range southward as far as the Tone River, north of Tokyo. From Aomori, Hakodate, and other ports great numbers are shipped in salt to every part of the Empire. The flesh is pale and rather soft, but palatable when freshly caught, and as a salted fish much appreciated.

This species we have hitherto identified with the common Dog-salmon, Calico-salmon, or Chum of Bering Sea and the American Coast, *Oncorhynchus keta* (Walbaum). This identification is probably correct, as renewed comparison discloses no difference.

The young fish is plain whitish, more or less dusted with dark points, but without black spots. With age the body becomes blotched or barred with dusky and dull red. The dorsal and pectoral fins are more or less blackish; the caudal edged with dusky. Vomer without teeth in the adult. The usual weight is from six to eight pounds.

The young female fish, described and figured by Jordan and Snyder as "*Oncorhynchus masou*" from Aomori, probably belongs to this species, but 190 scales were counted, the gill-rakers were 12+17=29, branchiostegals 13, anal rays 15. The fish in question was dusky, without spots. The old male figured by the same authors from Hakodate, must be the same species: scales 160, anal rays 14, branchiostegals 15+15. In these salted fishes the pyloric cœca, and usually the gills, have been removed.

It is possible that these two individuals represent a species distinct from *O. keta*, darker in color and with smaller scales. If so, figures 20 and 22 in Jordan, Tanaka, and Snyder should belong to it. As in *O. keta*, the body and fins are unspotted.

In the present collection is a single specimen (Collector's No. 452) a ripe female 19.5 inches long, from Sapporo, Hokkaido: anal rays 14; branchiostegals 13–14; gill-rakers 11+14=25; pyloric cœca 170; scales 138, structurally agreeing with the Dog-salmon, *keta*-type; one or two circuli continuous around exposed area, transverse axis widest, at end of its third year.

67. [121] **Oncorhynchus tschawytscha** (Walbaum).

Masunosuke = Lord of the Salmon.

In Japan the great King Salmon is said to occur only in the extreme north of the Hokkaido. A mounted example, probably from the Columbia River is in the Yamada Museum. This is not represented in the present collection.

Owing to the fact that studies in California by the junior author (working under the California Fish and Game Commission) have brought to light the occurrence of several remarkably well differentiated races of King Salmon, it will not surprise us at a subsequent date to learn of the existence in the Hokkaido, or regions to the north, of well-marked Japanese or Siberian derivatives of this species.

68. [122] **Oncorhynchus kisutch** (Walbaum). *Ginmasu* = Silver Salmon.

This common species of Alaska and the Pacific Coast of the United States is not yet definitely known from the main island of Japan. The land-locked or river-form, here called *Oncorhynchus ishikawæ*, has been several times identified as *O. kisutch*, of which species it is apparently a dwarfed off-shoot.

Counts of anatomical parts in a fairly large series of Silver Salmon in California have yielded the following results:

	Anal rays.	Cœca.	Gill-rakers.	Branchiostegals.	Scales.
Range	12–15	52–81	19–25	12–15	120–139
Mean	13.5	68.6	22.5	13.4	130
Number examined	34	66	28	34	17

Color silvery, with dark points and a few rather faint dark spots on top of head, back, dorsal fin, adipose fin, and upper rays of caudal; caudal unspotted below; dorsal fin more or less tipped with dusky; pectorals and anal dusky; breeding males mostly dull red, the head not black; no red on young examples.

In the United States this species normally reaches a length of about twenty to twenty-five inches and a weight of from six to ten pounds.

The specimens from Otaru, Ura River, and Osatsubo, mentioned by Jordan and Snyder, may belong to this species, as also possibly those taken at Aomori.

69. [122A] **Oncorhynchus ishikawæ** Jordan and McGregor, sp. nov.

Yamame; Kawamasu = River Salmon. (Plate VI, fig. 1; Plate VIII, fig. 6, scale).

Salmo perryi HILGENDORF, Monatsber. Ges. Ost-Asien, 1876, p. 25, Hokkaido (not of Brevoort, Exped. Japan, 1856, p. 273, pl. IX, fig. 1, from Hakodate, which is a species of *Hucho*).—JORDAN and SNYDER, Proc. U. S. N. M., XXIV, 1902, p. 578 (in part). Specimens from Daiya River.

This species has much in common with *Oncorhynchus kisutch*, from which species it was probably originally derived.

Our type of the species is an example from Lake Biwa (Collector's No. 1896, Car. Mus. Cat. Fishes No. 7786), obtained with four others by Dr. Wakiya. It is a young male, 7 inches long, with a young of *Rhinogobius similis* in its stomach.

Body symmetrical; head small, 4.33 in length; maxillary short, reaching little beyond eye, which is small, 1.6 in snout; caudal peduncle rather slender. Color very dark olive, paler on sides, with a few dark spots on back, but with numerous white or pink spots irregularly scattered among the others (these sometimes wanting); usually two or three small dark spots at base line of dorsal; apical third of dorsal jet-black, paler at base, a whitish spot on upper half of last five or six rays; no spots on the fins, except at base of dorsal, where two to six (usually four) black inky spots are usually evident. Anal and ventrals pale, the tips of both fins abruptly yellowish white; anterior rays of anal fin more or less produced; pectorals dusky above on first few rays; caudal with dusky margin behind; one or more (sometimes several) round blackish spots on side of belly in a series, these rarely entirely wanting, though growing obscure with age as the parr marks disappear, one below the dorsal most permanent.

Anal rays 13; branchiostegals 12–13; gill-rakers 9+12=21; pyloric cœca 51; vertebræ 58+6=64+U.; scales 133, structurally resembling the Silver Salmon (*kisutch*-type); about eight circuli continuous all around focus, which is central. Our ripe specimens have the scales rather badly absorbed and are seemingly in the third year.

A larger example, an immature male from Lake Hakone (Collector's No. 438), 9.625 inches long, shows the following characteristics: the spots and other markings mostly wanting or indistinct; the sides silvery; anal rays 12; gill-rakers 9+11=20; branchiostegals 13–14; pyloric cœca 55; scales 135, showing eleven or twelve circuli continuous around on exposed area; focus nearer anterior end; outline wide, elliptic, in general conformed to the type of the Silver Salmon in fourth year; caudal shallow-forked, with sharp angles; parr-marks mostly obliterated; color silvery with no red; the black spots few, small, and very faint on back, none on caudal, which is not edged with red. Dorsal fin deep black above, rather abruptly paler below, especially at end of last few rays, about four elongate dark spots along its base; pectorals pale slaty below, blackish above, especially on the anterior two-thirds of their width; anal with dusky band traversing it midway, apex lighter, the fin as a whole pale and small. The black area on the dorsal fin grows darker with age, but the spots on the sides tend to disappear, the sides becoming silvery. This specimen approaches maturity. We have a smaller one, much like it, also from Lake Hakone.

Thirteen specimens of different sizes from four to six inches long, paler in color, and with the parr-marks very conspicuous, were taken by Dr. Ishikawa on a special trip to the Shibu River (Shibugawa), a mountain-stream near Ikao in Kotsuke, Central Japan. These are variously spotted with black, a series of larger spots along side of belly being almost always conspicuous (sometimes wanting, or at other times duplicated); often with a dark spot below last ray of dorsal, and smaller inky spots along its base. Vertebræ 64 in all X-rayed specimens.

From various localities in Southern Japan come thirteen specimens 3.5 to 7 inches long, their colors more or less faded. One of them from Uwajima has 69 vertebræ, one 68, the others 63 to 66. The branchiostegals vary from 11 to 14, usually 12–13, the left side usually having one more than the right; gill-rakers usually 8+10=18; cœca 37 to 58; scales 125 to 140, the latter number in the specimen (Coll. Wakiya, No. 536) from Uwajima; scales with five to eight circuli continuous around exposed area, well separated; the scales of the Silver Salmon (*O. kisutch*) type, also of the scale type of a paratype of *Oncorhynchus formosanus* (Jordan and Oshima); mostly in second year.

Other examples come from the Kitakami River at Sendai (vertebræ 65, 65, 65; cœca 46, 41, 45; gill-rakers 18, 18, 18); one from the Kiso River in Shinshu (vertebræ 68; cœca 37; gill-rakers 18); two from Hamada (vertebræ 66, 64; cœca 45, 58; gill-rakers 18, 18); one from Toyama (vertebræ 63; cœca 42; gill-rakers 19); two from a stream in Hokkaido (vertebræ 64, 64; cœca 48, 41; gill-rakers 18, 18); two from Kumamoto, (vertebræ 64, 64; cœca 55, 41; gill-rakers 18, 18); and one from Uwajima (vertebræ 69; cœca ?; gill-rakers 18; scales 140).

This is certainly the common "trout" or "Yamame" of central and northern Japan, and it is most probably a derivative of *Oncorhynchus kisutch,* differing in its dwarf size and darker colors. It may always be known by the black upper part of the dorsal, which scarcely fades in spirits. The dark spots on the lower part of the sides are also characteristic in the young.

The anatomical characters of the foregoing series of individuals may be summarized as follows:

	Anal Rays.	Cœca.	Gill-rakers.	Branchiostegals.	Scales.	Vertebræ.	Age in years.
Range........	11–13	37–58	18–19	11–14	123–140	63–69	1–4
Mean.........	12.2	43.6	18.1	12.5	129.4	65.1	2

In all of these examples the ground-color of the peritoneum ranges from deep straw-color to smoky rose, with paler rib stripes and scattered black stipplings.

70. [122 in part] **Oncorhynchus macrostomus** (Günther).

Ameno-uwo (male) = Rain-fish; *Amago* (female); *Enoha.*

(Plate VI, figs. 2–3; Plate VIII, figs. 8–9, scales.)

Salmo macrostomus Günther, Shore-fishes, Challenger, Exped., 71, pl. XXXI, fig. 8 (Yokohama market).

Salmo perryi Jordan and Snyder, Proc. U. S. N. M., XXIV, 1902, 578, (in part); examples from Lake Biwa and other localities in Southern Japan (not of Brevoort).

This species is widely diffused in the streams and lakes of Southwestern Japan. It is highly variable in color, according to the nature of the water, and unfortunately in museum specimens as to its condition of preservation. As in other fresh-water *Salmonidæ*, the differences between individuals are much more impressive than the characters which distinguish species.

The species is, however, distinguishable at all times from its nearest relative, *Oncorhynchus ishikawæ*, by the total absence of a large black blotch on the upper part of the dorsal fin. From *O. rhodurus* it is separated by more technical characters, especially of the scales, and by the marked difference in character and adjustment of the dark spots, which in *O. rhodurus* are not present below the lateral line.

Of this species the most typical examples are a series from Lake Hakone, seven to nine inches in length, both sexes being represented, the largest quite mature. These in life show the following colors: dorsal fin pale above, smoky below, never black above, usually with three to eight small prevalently round spots along its base, no black spot on base of first ray; adipose fin unspotted, usually dusky at base in front. Head very dark above. Back with small dark spots, these in the more sharply marked examples continuing upon the head in rather definite arrangement; a bowed line of eight or ten along occipital border; a similar arched line over each eye; none reaching lateral line. Caudal fin with two or three spots, sometimes with none; with pale edges which are red in life, as in *O. rhodurus* and *O. ishikawæ.* Lower fins dusky, paler than in *O. rhodurus*, the tips vaguely lighter. Anal anteriorly dusky, the tip rather sharply pale; no spots at base. Pectorals dark-edged above. Sides of body with seven to nine large round blackish blotches, parr-marks, which, however, do not seem to be wholly lost with age. Above these and alternating with them are large round obscure blotches, which fade with age. Mixed with the black spots and blotches are scattered crimson spots above the lateral line, usually larger than the black ones. Sides below lateral line with one to five series of often twenty round black spots, unequal in size, most of them very distinct, but reduced in some examples to a single large spot on side well below the dorsal fin. Usually there are several series of these spots, the smaller ones extending upon the belly.

Of the two examples figured in this paper, the one is a young male, collected by Dr. Ishikawa in Nagara River near Gifu. This specimen was much faded and the original markings have been restored from a specimen of the same size from Lake Hakone. The other figure is from a very highly colored young male from Lake Biwa. The first of these differs from Günther's plate only in the much smaller mouth. From Gifu we also have a more mature male, in which the maxillary is very much longer, a character apparently due to greater maturity. None of our examples show a hook-nose, nor any tendency in that direction.

The example figured (Plate VI, fig. 3) from Lake Hakone (Coll. No. 450) (Car. Mus. Cat. Fishes, No. 7790) shows the following traits: Head 3.75 in length to base of caudal; depth 5; eye 5.75 in head; snout 3.15; maxillary 2 in head (1.5 in more mature examples). Anal rays 12; branchiostegals 13–14; gill-rakers 9+11=20; scales 116; pyloric cœca (lost), 57 or 58 in other examples; vomer with a long line of teeth in zigzag; caudal lunate, with bluntish lobes, not deeply forked; length 8.75 inches; scales with focus central, about six circuli continuous around exposed area, much more widely spaced posteriorly; wide transversely; in third year (other examples from Lake Hakone mostly in fourth year). Body in spirits much faded, but showing faint parr-marks, scarcely silvery; anal dusky at base, with conspicuous white tip; back with rather few spots; sides nearly plain; caudal nearly or quite unspotted; dorsal dusky, paler at tip, unspotted, except for three to five black spots present at its base; anal rather low, pale at its tip, or entirely pale.

The other of the two specimens figured (Plate VI, fig. 2) is an immature male, seven inches long, from Lake Biwa, obtained from a private hatchery in Otsu by Jordan and Kawamura. In this specimen the very dark color obscures the black spots, leaving the crimson spots even more conspicuous; in life the dark spots on the side are very obscure and there are none on the head; the anal is broadly tipped with orange; the unspotted caudal is trimmed above and below with red.

Ten other examples, similar to this and as brightly colored, ranging in length from four to seven inches, were obtained. The following characteristics are exhibited by the specimen figured (Collector's No. 454, Car. Mus. Cat. Fishes, No. 7791). Anal rays 12; branchiostegals 12–13; gill-rakers 6+11=17; pyloric cœca 49; scales 130, structurally of the type of the Silver Salmon, *O. kisutch*; focus central; 11 circuli continuous around on exposed area; in second year.

Of *Oncorhynchus macrostomus* we also have three examples from the Hiki River at Wakayama, which are comparatively large and dark in color, the black spots almost obliterated. In addition we have one from Hamada, five from Himeji, three from the Kuma River at Kumamoto, five from Toyama, Fukui, one each from Lake Kizaki, Echizen, and Uwajima, besides those already noted from Lake Hakone, Lake Biwa, and the Nagara River. Of these only four show the maxillary as long as shown in Günther's figure (1.5 in head).

This species seems to be the most abundant form in the streams south and west of Lake Biwa; its northern limit, so far as our collections show, being Lake Hakone. How many kinds of these "Yamame" in this remarkable lake are really indigenous, and what may have been introduced in the long period of Japanese civilization, no one can tell. It is certain now that *O. rhodurus*, *O. macrostomus*, and *O. ishikawæ* all exist there in almost equal abundance, besides *O. adonis*, a species of a very different type. *O. macrostomus* is reputed to be non-migratory. It seems to reach only a small size and the males seen, while having the jaws prolonged backward, show no signs of a hook.

The character of the scales, which, as in *O. ishikawæ,* have but few (seven to ten) circuli continuous on the exposed area, sharply distinguishes these species from *O. rhodurus*, in which the circuli range from 21 to 31. The black tip of the dorsal fin is the only constant character we have found sharply to set off *O. ishikawæ* from *O. macrostomus*. In both the dark spots normally extend below the lateral line, and are often mixed with red ones. The round parr-marks in both are very persistent, and in the young the additional alternating dorsal row is conspicuous.

Tabular Summary of Characters of Oncorhynchus Macrostomus.

Localities.	Cœca	Gill-rakers.	Anal Rays	Branchio-stegals.	Scales.	Vertebræ[27]	Head, per ct. in length.	Maxillary per ct. in length
Lake Biwa....	41–61	17–21	12–13	11–14	126–133	64–66	♂, 24–28	♂, 15–17
Average....	51.2	19.2	12.5	12.5	....	64.8	♀, 25–27	♀, 15
Lake Hakone..	...	18	12–13	12–14	126–143	63–64	♂, 27–30	♂, 16–19
Average....	...	...	12.4	13.1	...	63.4	♀, 25	♀, 14
Fukui........	40–45	17–20	12–13	11–14	124–142	63–65	♂, 25–26	♂, 13–15
Lake Kizaki...	49–55	17–19	12–13	11–14	122–132	64	♂, 26–27	♂, 15–16
Six other localities....	43–57	18–21	12–13	12–14	120–130	62–64	25–31	13–20

Closely allied to *Oncorhynchus macrostomus* is the species recently described from the mountains of Formosa, as *Salmo formosanus* Jordan and Oshima (Proc. Acad. Nat. Sci. Phila., 1919, 122). In this species, the anal is very high, its first rays reaching beyond tip of the last. A. III, 10; scales 130; branchiostegals 13; gill-rakers 7+9=16; distal parts of all fins dusky.

71. [124] **Oncorhynchus rhodurus** Jordan and McGregor, sp. nov.

(Plate VII, fig. 1; Plate VIII, figs. 1–2, scales).

Oncorhynchus masou Jordan and Thompson, Mem. Car. Mus., VI, 211, pl. XXIV, fig. 3, (not text).

The type of this well marked species is a mature male 20.25 inches long (Collector's No. 2218) (Car. Mus. Cat. Fishes, No. 7794) with very strongly hooked jaws and nuptial colors, taken in Lake Hakone, Sagami, November 20, 1923, presented by Mr. Henry Kanaya Yamaguchi, proprietor of the noted Fuji-ya Inn at Miyanoshita.

This specimen shows the following characters: body robust, compressed; jaws much hooked, the long upper jaw overlapping the lower; anal fin of moderate height, first ray fully reaching to middle of last ray; tip of first few rays produced; caudal subtruncate or shallowly lunate; anal rays 12; branchiostegals 11–12; gill-rakers 8+10=18 (very short); pyloric cœca 42; vertebræ 63; scales 133, (in poor shape from absorption), structurally of a modified *O. kisutch* type, showing a few reticulations, at least six circuli completely surrounding focus, these much more widely spaced posteriorly; at least in its fourth year 21 to 31 circuli in all on exposed area.

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[27] Determined by X-ray photographs.

Color in life: head jet-black; sides bright greenish, with only a few black spots, these chiefly confined to the back. Parr-shades faint, the interspaces pink, contrasting with the green of the sides; no red stripe along sides; a bright red stripe along outer rays of caudal above and below, fading in spirits to whitish, that on the lower rays most distinct; black spots on dorsal numerous, small, more or less oblong and oblique; spots on base of fin few, oblong and obliquely set; tips of dorsal, anal, and ventrals broadly creamy white; pectorals with obscure dark edging distally; caudal lobes short, acute, a few black spots above and below: inside of mouth blackish, one vomerine tooth remaining.

A microscopic study of the scales of No. 2136 (a paratype thirteen inches in length) reveals that the individual was seven years old and had never spawned before. This equals the maximum longevity hitherto recorded for *Oncorhynchus*.

Three female specimens, ripe with eggs, about a foot long, from Lake Hakone (November 20) are much smaller and slenderer; dull sooty-silvery in color with traces of dark spots above, and faint pinkish shades in the interspaces, alternating with traces of dark bars. Upper and lower edge of caudal pale, but (in spirits) no longer red; numerous smaller oblong, oblique spots, arranged vaguely in rows along the rays, those at base of the fin oblong, oblique, ink-like, sometimes running together in a broken line; caudal with a few dark scattered spots; none on ventrals or pectorals; paired fins dark, with abrupt yellowish white tips.

A younger male is like the old one, but less brightly colored and barely beginning to be hook-nosed. It has still a long row of five small vomerine teeth.

Two spawning females, (from some locality in Shinshu) one about a foot in length, and one about 17.5 inches long, exuding ova, are dusky metallic-sooty, with traces of dark bars, these quite unlike the rounded parr-marks of other species; no red on fins, except on lower ray of caudal; spots mostly obliterated; anal with a broad white tip; adipose fin with a dark spot above; anal usually with a few dark spots at base; no series of dark spots along side below lateral line in either specimen.

Parr-marks mostly early replaced by broad vertical dark cross-bars, which in the males tend to grow sharper with age; pectorals deep slaty, as are also the other lower fins, except for the pale tips; young without red spots on sides. The faint broad dark cross-shades are characteristic of this species.

Of *Oncorhynchus rhodurus* we have six examples of various sizes and both sexes from Lake Hakone, and two from some lake in Shinshu, near Nagano. The species may be known at sight by the pale dorsal as well as by the absence of dark spots below the lateral line. A much more important character is found in the presence on each scale of many (21 to 31, the average 25.4) unbroken circuli on the exposed part of the scale. In *Oncorhynchus macrostomus* and *O. ishikawæ*, the unbroken circuli on the posterior surface are few (7 to 10, averaging 8) and the spotting is different.

In spite of resemblance to *Salmo*, this species is a true *Oncorhynchus*. Like *Salmo*, it has twelve anal rays, mostly eleven or twelve branchiostegals, seventeen to twenty gill-rakers, and one hundred and thirty-three scales in lateral series. The fact that the first anal ray reaches beyond the middle of the last ray marks most of our species of *Salmo*. On the other hand, the number of cœca (averaging 57), the number of vertebræ (about 63), but more particularly the well developed hooked nose in the ripe males, and the death of all spawning individuals, identify it as an *Oncorhynchus*.

Oncorhynchus rhodurus is the species figured by Jordan and Thompson, Mem. Car. Mus., VI, 1913, p. 211, pl. XXIV, fig. 3, as *Oncorhynchus masou*. The specimen figured, Car. Mus. Cat. Fishes, No. 6002a, was taken in Lake Chiusenji, a land-locked mountain lake, in which it was said to have been introduced from Akita in Ugo in the northwestern part of Japan. We were told that all individuals in the lake die after spawning. The figure in question accurately represents a young male, except that the black spots have faded.

A specimen from Naoetsu, Echigo, is in the Stanford University Museum, collected by K. Otaki.

The following table gives the record of our various examples.

TABULAR SUMMARY OF CHARACTERS OF ONCORHYNCHUS RHODURUS.

	Cœca.	Gill-rakers.	Anal Rays.	Branchiostegals.	Scales.	Vertebræ.	Head pr.ct. in length.	Maxillary pr.ct.in length.
Range........	42–76	17–20	12–13	11–13	124–133	62–63	♂, 29–33 ♀, 24–25	♂, 19–22 ♀, 13–14
Mean........	57.4	18.6	12.4	11.8	128	62.7		

Subgenus *Trutta* Linnæus.

72. [Introd.] **Salmo shasta** Jordan. *Shasta Rainbow-trout*

A specimen from Lake Biwa, presented by Dr. Ishikawa, belongs to this American species, which was introduced from the hatchery at Baird on the McCloud River near Mount Shasta, California. The body and upper fins are profusely spotted, much more so than in any Japanese species.

Genus Salvelinus (Nilsson) Richardson.

The species of Charr found in tributaries of the North Pacific are very far from final determination. The name *Salvelinus malma* evidently belongs to a northern form, known from Unalaska to Kamchatka. Close to this, but with the head constantly larger, is the "Dolly Varden," or "Bull-trout" of Northern California and northward. This may stand as *Salvelinus spectabilis*[28] (*parkei*), and probably grades into the preceding. Both of these enter the sea, growing to the weight of eight to ten pounds, the red spots becoming silvery. In all the mountain-streams of northern and middle Japan the common trout, or *Iwana*, *Salvelinus pluvius*, agrees closely with *S. malma*, but its pyloric cœca and gill-rakers average fewer and the spots on the side and back are larger.

Another group of Charr has the pale spots much larger, some as large as the eye, otherwise much like *S. pluvius*. Specimens from Kamchatka (*S. leucomænis*) have the head short, 4.5 to 4.66 in length. A related form or species of this type, from Hamada in Iwami, has the head 4 in length and the cœca very few, only seventeen. This we call *Salvelinus imbrius*, granting it, pending study, the rank of a distinct species.

Key to Pacific Species of Salvelinus.

a. Lateral spots all smaller than eye, mostly smaller than pupil, bright crimson, becoming silvery in sea-run examples; no spots on head, and usually few or none below lateral line; lower fins with the first ray bright red.
  b. Head long, more than one-fourth length of body to end of vertebræ (3.66 in length) gill-rakers 18; pyloric cœca 18. Shasta region and northward.................... *spectabilis.*
  bb. Head shorter, less than one-fourth length of body.
    c. Pyloric cœca 24 to 33; gill-rakers 20 to 24; branchiostegals 11–12; head 4.25 to 4.5 in length; North Pacific.. *malma.*
    cc. Pyloric cœca 23 to 25; gill-rakers 18 to 20; branchiostegals 12–13; head 3.875 to 4.4 *pluvius.*
aa. Lateral spots pale yellowish, irregular in size, mostly larger than pupil, some about as large as eye, extending more or less below lateral line; lower fins pale; scales about 200.
    d. Head 4.5 to 4.66 in length; no spots on head; caudal well forked; cœca 20; gill-rakers 18; branchiostegals 13–13. Kamchatka and Hokkaido. *leucomænis.*
    dd. Head 4 in length; pale spots covering top of head; caudal shallow-forked; cœca 17; gill-rakers 14; branchiostegals 12–13. Hamada in south western Japan.. *imbrius.*

The foregoing analysis of these forms is provisional and all may prove to be variants of *Salvelinus malma.*

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[28] The name *spectabilis* Girard must take precedence over *parkei* for the American "Dolly Varden." Girard called the species *Salmo spectabilis*. The earlier name *Salar spectabilis* was applied by Cuvier and Valenciennes to a European species of *Salmo*, but the combination, *Salmo spectabilis*, was first used by Girard for the Charr of the Columbia.

73. [127] **Salvelinus pluvius** (Hilgendorf). *Iwana.*

(Plate VII, fig. 2, example from Shinshu; Plate VIII, fig. 14, scale).

The common Red-spotted Charr, or *Iwana,* is found in all the mountain-rivers and brooks from the southern part of Hondo throughout the Hokkaido. Our specimens are from the Daiya River at Nikko; Lake Chiusenji (introduced); the Kawajiri River in Rikuchu; and Ohata, near Aomori, besides those obtained by Jordan and Snyder in 1900. The two from Ohata are very slender, apparently starvelings. Whether the *Iwana* is really separable from *Salvelinus malma* of the Kamchatka-Alaskan region is doubtful, as already indicated.

Besides the ordinary *Iwana,* found in all mountain-streams of Japan, we have a fine specimen, 11.5 inches long, (I. W. No. 207) in the collection. It is a ripe male with the lower jaw somewhat hooked and slightly prolonged, and was taken in a stream or lake in Shinshu, near Nagano, by Soji Nakona. It differs from others in the subtruncate caudal and its rather larger spots. Body rather elongate and moderately compressed; head slightly under 4 in length to end of vertebræ; depth 5; depth of caudal peduncle 2.84 in head; eye 6.5; interorbital space 3.33; snout 3.6; maxillary 1.66, extending beyond eye a distance about equal to diameter of eye; D. 9; A. 8; scales in lateral series 185, in transverse series above lateral line 38. Vomer flush with roof of mouth, on its anterior portion teeth in a fan-shaped cluster, none on the depressed shaft; palatine teeth extending to anterior vomerine teeth, with a very short gap between; roof of mouth, within palatines and behind teeth of vomer, black; branchiostegals 13–13; gill-rakers $7+8=15$; pyloric cœca 21; dorsal fin a little longer than anal, the former 1.75 in head; ventrals 2.1 in head; caudal almost squarely truncate, the lobes not acute, over 2 in head, the middle rays more than two-thirds the outer; ventral appendage 2.5 in fin; longest ray of dorsal 1.75 in head. The difference in the form of the caudal is a striking feature of this specimen and is probably due to age. Scales under microscope show that the outline is usually rectangular-elliptic, with the antero-posterior axis the longest; focus nearly central, sub-circular; most of the circuli continued around on the exposed area, which appears much like the concealed area; circuli widely spaced, inclined to interbranch, especially on the anterior radius; blank area restricted to two posterior marginal circuli; submarginal blank zone limited to axial portion of circuli nine, ten, eleven, and twelve posteriorly; radial spurs common. This specimen is in its fourth year. Color (in alcohol) smoky-brown above lateral line, paler below; back blackish-gray; many small round pale spots (red in life) scattered over sides and back, most of these about half the diameter of the pupil, not visibly arranged in rows; a few below larger; all fins unspotted; head, especially above, dark slaty; dorsal fin slaty, the first ray palest; caudal fin slaty, unspotted, margined above and especially below with whitish; pectorals, ventrals, and anal pale slaty, all bordered anteriorly with rather wide, pale edging; pectorals and ventrals darker above.

74. [126] **Salvelinus leucomænis** (Pallas). (Plate VIII, fig. 13, scale.)

Salvelinus kundscha JORDAN and GILBERT and of other authors, probably not *Salmo kundscha* Pallas (*fide* Berg).

This trout, long known from Kamchatka, is recorded by Jordan, Tanaka, and Snyder from Nemuro and the Shiribeshi River, in the northern Hokkaido. Also from Iturup Island of the Kuriles, and from Shinano. It is visibly known by its large pale spots, creamy in preserved examples, of unequal size, some about as large as the eye, none extending on the head.

According to Dr. Leo S. Berg, the early specific name *kundscha* should not be used for this species, as the original of the name was probably *Salvelinus alpinus,* a European species entering the Arctic seas. We, therefore, take the earlier name of reasonably certain application.

75. [126A] **Salvelinus imbrius** Jordan and McGregor, sp. nov.
(Plate VII, fig. 3; Plate VIII, fig. 15, scale.)

This species is based on an immature female, 9.25 inches long (W. No. 510) Car. Mus. Cat. Fishes, No. 7797, obtained from a stream near Hamada in Iwami in the southwestern part of Japan. It is very close to *Salvelinus leucomænis,* which subarctic species it may represent southward.

Body moderately elongate, not much compressed, dorsal contour slightly elevated back of occipital region; caudal fin shallowly forked; head about 4 in length; depth 4.5; depth of caudal peduncle 2.6 in head; eye 5.4; interorbital space 3.125; snout 4.33; maxillary 1.875; extending beyond eye a distance about equal to diameter of pupil; dorsal rays 12; anal-rays 9; scales in lateral series (immediately above lateral line) 195. Vomer flush with roof of mouth, four teeth in a cluster on anterior portion; roof of mouth longitudinally striated with pale and blackish shades; distance from tip of teeth on vomer to tip of snout one-third interorbital space; about twelve palatine teeth on each side; tongue short, blunt, of a rusty color, with two rows of about five teeth on each side; teeth essentially as in *Salvelinus pluvius* and other species of *Salvelinus.* Branchiostegals 12–13; gill-rakers 5 + 9 = 14; pyloric cœca 17; vertebræ 59 (53 + 6 + urostyle) only the last two slightly up-turned; dorsal equaling anal, 1.66 in head; pectorals

1.5 in head; ventrals fully two in head; ventral appendage about four in the fin; caudal shallowly forked, the lobes obtusely angled; its length 2.25 in head; peritoneum smoky, with pale stripes along ribs and a few scattered stipples. Scale under the microscope shows the outline usually wide rectangular-elliptic, with the antero-posterior axis longest; focus central, circular; circuli nearly all continuous entirely around, widely spaced, nowhere angled; blank area restricted to one or two peripheral circuli posteriorly, and occasionally also to axial portion of circuli four, five, and six; nucleus of about nine circuli, which are spaced increasingly wider toward focus; radial spurs present or absent (when present scarce). Our specimen is in its fourth year. Color in spirits pale slaty-brown above, paler below, but back hardly darker than sides; numerous round pale spots equally distributed over back, sides, and top of head, the largest larger than pupil and some almost as large as eye; top of head with about sixteen spots smaller than those on sides; spots extending to below lateral line. Dorsal fin rather pale, a horizontal slaty bar across middle of rays, a blackish border on first ray; caudal somewhat dusky; basal half of ventrals whitish; anal, ventrals, and pectorals pale, the first rays of each paler, pectorals very slightly dusky above; lateral line conspicuously whitish.

TABULAR STATEMENT OF ANATOMICAL CHARACTERS OF PACIFIC SPECIES OF SALVELINUS.

Species.	Locality.	No. of cœca.	Gill-rakers.	Branchiostegals.	Head in length to end of vertebræ.
S. spectabilis	Rattlesnake Cr., Mont.	18	18	12–13	3.66
S. malma	Unalaska	27	20	12–11	4.5
		33	20	11–11	4.5
	Pt. Hope, Alaska	24	24	12–12	4.5
		..	23	10–11	4.25
S. pluvius	Chiusenji	..	..	12–13	
				1 –13	
				13–14	
				14–15	3.875
	Kamajiri R.	25	18	12–13	4
	Rikuchu	23	20	12–12	4
	Ohata	23	18	11–11	4.4
		..	19	12–12	4.4
	Shinshu	21	15	13–13	3.8
S. leucomænis	Nemuro	20	18	13–13	4.25
	Petropavlovsk	22	20	13–13	4.125
S. imbrius	Hamada	17	14	12–13	4

For an account of the pyloric cœca and measurements of head of examples of *Salvelinus spectabilis* from near Seattle we are indebted to Professor John N. Cobb of the University of Washington.

	Length to Base Caudal Ray		Length of Head to Nape		Length of head to Margin of Opercle		Length of Head in Body		Number of Pyloric Cœca	Sex
	In.	Cm.	In.	Cm.	In.	Cm.	Head to Nape	Head to Opercle		
1.	25.5	64.77	4.0	10.16	6.5	16.51	6.37	3.92	25	Male
2.	23.0	58.42	3.5	8.89	5.75	14.60	6.57	4.00	23	Male
3.	19.56	49.68	3.31	8.41	5.62	14.29	5.9	3.48	23	Female

CHARACTERS OF SCALES OF SALVELINUS.

(Best applicable to scales from between dorsal fin and lateral line)

A. All circuli extending entirely around scale; focus central; no true blank area.

  B. Outline cuneate-ovate; radial spurs usually present (at times lacking); circuli interbranching considerably, especially anteriorly, numbers one to four commonly angled postero-axially. *leucomœnis* (Kamchatka).

  BB. Outline ovate; radial spurs normally absent; circuli relatively little interbranched, inner ones more apt to be angled anteriorly.................................... *spectabilis* (Seattle). (Plate VIII, fig. 17)

AA. All but two or three circuli extending entirely around scale; marginal blank area restricted to one to three posterior peripheral circuli; a submarginal blank area present on exposed area in most species.

    C. Circuli usually abruptly bent on radii bounding exposed area; outline cuneate-ovate; submarginal blank area restricted to axial portion of circuli Nos. 6 to 8. *malma* (Bering Sea). (Plate VIII, fig. 16)

    CC. Circuli not so bent.

      D. Focus sub-central, often somewhat nearer the posterior end; outline oval, widest posteriorly; circuli commonly angled on long axis; radial spurs present; submarginal blank area restricted to axial portion of circuli Nos. 5 to 7 *pluvius* (Chiusenji).

      DD. Focus central; circuli not angled, widely spaced; outline elliptic to rectangular-elliptic.

        E. Submarginal blank area not present, several posterior circuli usually somewhat broken; radial spurs usually lacking; circuli relatively unbranched (starved examples).................................... *pluvius* (Ohata).

        EE. Submarginal blank area present.

          F. Radial spurs conspicuous; submarginal blank area restricted to circuli Nos. 9 to 12; circuli inclined to interbranch on anterior radius. *pluvius* (Shinshu).

          FF. Radial spurs few and inconspicuous; marginal blank area restricted to axial portion of circuli Nos. 4 to 6.............. *imbrius* (Hamada).

AAA. Few to eight circuli extending all around scale.

          G. Focus central; circuli not angled.

            H. Focus usually well elongate; only two to four circuli extending all around scale; blank area comparatively large. *fontinalis* (Maine).

HH. Focus only slightly elongate; six to eight circuli extending entirely around; blank area relatively small, restricted to a rather narrow triangle at posterior end.... *pluvius* (Rikuchu).

GG. Focus commonly somewhat nearer posterior end; first three or four circuli usually angled posteriorly.

I. Focus sub-circular; six or seven circuli extending entirely around; blank area large, its anterior margin almost a vertical line; radial spurs present; circuli closely spaced; outline rectangular-ovate, widest at a point one-third distant from focus to anterior end..*S. malma* (Unalaska).

II. Focus elliptical; six to eight circuli extending all around; blank area restricted to outer four circuli (No. 6 usually interrupted postero-axially); no radial spurs seen; outline rectangular-elliptic.............................. *fontinalis*. (Swannanoa R., North Carolina).

From this table it will be seen that a close alliance is indicated between *S. pluvius* and *S. imbrius.* Our key, based on scale-characters, brings these two forms closely together. *Salvelinus fontinalis* from Maine shows a rather close relationship to *S. malma* from Unalaska, when the scales are the only features considered. It also indicates a substantial difference in the number of cœca and gill-rakers as between the Bering Sea and Unalaskan individuals thus far referred to *S. malma.* These two are widely separated in the scale-key.

On the other hand the critical study of the scales tends to refute in two instances the integrity of our tabulated analysis (See p. 140). First, the three collections of *Salvelinus* from Rikuchu, Ohata, and Chiuzenji (R. Daiya) (all listed in the Stanford Collection as *S. pluvius*), when subjected to the scale scrutiny fall, two into one primary structural division and one into another, indicating a lack of identity. Secondly, *Salvelinus imbrius* (from Hamada) has been placed, tentatively, near *S. leucomænis,* chiefly on account of the possession in common of body-spots larger than the pupil. On the contrary, it will be noted that the critical scale characters are quite different in these two forms, which discrepancy is accompanied by a difference of *four* in the number of gill-rakers. Finally, two individuals from Montana (*S. spectabilis*) when placed in our table, exhibit relationship both with *S. fontinalis* from North Carolina and *S. leucomænis* from Nemuro. However, when subjected to the scale-test, this form from Montana shows no kinship with the eastern Brook-trout, *Salvelinus fontinalis,* while the alliance with *leucomænis* (Nemuro) is greatly emphasized.

76. [125] **Hucho perryi** (Brevoort). *Ito-uwo* = String-fish. (Plate VIII, fig. 7, scale).

Salmo perryi Brevoort, Exped. Japan, 1856, 273, pl. IX, fig. 1, (Hakodate).

Salmo blackistoni Hilgendorf, Monatsber. Ges. Ost-asien, 1876, 25, (Hokkaido).

A specimen of this interesting trout-like fish in the Stanford collection was obtained by Professor Otaki at Naoetsu in Echigo. A larger example was examined in the Lakeside laboratory of the University of Kyoto. It is not so slender as the one figured by Jordan, Tanaka, and Snyder, and the spots, though similarly placed, are more diffused, and not lunate.

This species is smaller and slenderer than its congener, *Hucho hucho* of the Danube, but otherwise the two species have very much in common. This "Huchen" is said to reach a weight of sixty to one hundred pounds.

Hucho stands out as very distinct from the other *Salmonidæ*, especially in its dentition, its fewer vertebræ, and the great number of its pyloric cœca. It is not known to enter the sea. It should apparently form a separate subfamily, *Huchoninæ*.

The following characters are shown by the example from Naoetsu: head 3.33 in length to end of last vertebra, depth 5; eye 6.75 in head; maxillary 2; snout 3.75; depth of caudal peduncle 2; height of dorsal 1.66; pectoral fin 1.75; dorsal rays 11, anal rays 10, pectoral 14; gill-rakers rather short and stout, 8+12=20; branchiostegals 12–12; pyloric cœca 157, short, densely imbricated, the largest only 8 mm. long by 1.5 thick. Scales 105; pores in lateral line 109. Vertebræ 57 (51+6 upturned, besides the urostyle). Body long and low, somewhat pike-like, not much compressed, the mouth large. Dentition peculiar; only vomer with a short transverse series of teeth, none on the shaft; the teeth continuous with the palatine series of the two sides, the whole forming an unbroken and nearly uniform U-shaped series. In other *Salmonidæ*, the palatine teeth are interrupted by the presence of the vomerine element. Scales relatively large, the entire surface marked with concentric circuli, about one-seventh of those of the concealed surface not continued on exposed area, resulting in a slightly wider spacing on this part. First four or five (central) circuli angulate at the posterior axis. The type of scale is thus intermediate between *Oncorhynchus* and *Salvelinus*. Caudal rather deeply formed, with acute lobes; ventrals nearly under middle of dorsal; adipose fin rather large. Head and body rather profusely covered with small black spots, few of them extending below lateral line and most of them not larger than a scale; fins all unspotted.

COMPARISON OF GENERA OF SALMONIDÆ AND PLECOGLOSSIDÆ.

Genera.	Cœca.	Gill-rakers.	Anal Rays.	Branchiostegals.	Scales.	Vertebræ.
Oncorhynchus	40–230	18–40	12–16	11–17	120–215	62–69
Salmo	65	....	9	11	120	60
Trutta	40–60	20	10	11	120–190	58–60
Salvelinus	17–21	14–20	8–12	12–13	185–250	59–65
Hucho	157	20	10	12–12	105	57
Plecoglossus	368–425	33–39	9–17	5–5	140–165	60–61

Family PLECOGLOSSIDÆ.

(By David Starr Jordan and Ernest Alexander McGregor.)

77. [128] **Plecoglossus altivelis** Temminck and Schlegel. *Ayu*; *Koayu.*

(Plate VIII, figs. 10 and 12, scales).

Common throughout Japan and Formosa, ascending clear streams from the sea, spawning in the early fall. Also found land-locked and much dwarfed in Lake Biwa. It is one of the very choicest of Japanese food-fishes.

In this genus the vertebral column ends squarely at the base of the caudal fin, the terminal vertebræ being neither reduced in size, nor turned upward (heterocercal) as in the *Salmonidæ*, a fact finely shown in X-ray photographs made by Mr. McGregor.

Our specimens are from Noo, Toyama, Himeji, Mikawa, (four), and from Lake Biwa at Otsu (dwarf examples),[29] locally known as "*Koayu.*" Specimens of *Ayu* from Formosa seem to be identical with the ordinary form.

Gill-rakers 41; dorsal rays 11; anal rays 15. The scales are decidedly longer on the dorso-ventral axis, at which line the circuli bend sharply. Branchiostegals typically 5–5 (rarely 4–4); anal rays about 14; gill-rakers about 36; pyloric cœca about 388; vertebræ 60–61; scales in linear series just above lateral line about 161; scales comprising lateral line about 62. Scales structurally as follows: decidedly broadest on transverse axis; first four or five circuli with segments lying nearly straight and parallel behind the focus, which is compressed elliptical; balance of circuli tangentially deflected posteriad; major portion of exposed area (which is normally ampler than concealed area) not bearing circuli (juvenile individuals excepted); outline of scale concave laterad of focus. Mostly two and three years old. The breeding males have the exposed surface of each scale usually bearing three cone-shaped warty processes (pearl-organs).

The following table contains a summary of the more important anatomical characters shown by our material:

	Branchiostegals.	Anal Rays.	Scales along lateral line.	Gill-rakers.	Pyloric cœca.	Vertebræ.
Range............	4:4–5:5	9–17	149–165	33–40	368–425	60–61
Mean............	5:5	14.4	161.4	36	388.3 [30]	60.5

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[29] These have gill-rakers 35, anal rays 14, and scales in lateral series 152. In the lot are some ripe males between 2.75 and 3 inches long.

[30] Only three counts as follows: 368; 372; 425.

The breeding males of *Plecoglossus* undergo a very marked nuptial transformation involving chiefly the dermal armature and the fins. Warty growths, called "pearl-organs," or "nuptial tubercles," develop on the scales and also overlie the fin-rays, especially on the anal fin. This imparts to the fish a conspicuously roughened appearance. Accompanying this is a very noticeable enhancement of the size of the fins. To reveal this we append the measurements of a ripe female, of a ripe male, and of an unripe male of equal length.

	Length of Pectoral.	Length of Dorsal.	Length of Ventral.	Length of Anal.	Length of Anal Base.	Length of Maxillary.
Ripe Male.........	17.8[31]	20.5	17.2	11.3	18.0	11.7
Unripe Male.......	14.0	16.6	11.2	12.7	12.4	12.6
Ripe Female.......	14.8	17.6	11.0	12.8	14.4	12.1

The length of the maxillary of the male, which with most of the Salmonid fishes is augmented at maturity, would appear to undergo a reverse process in *Plecoglossus* as our nuptial males invariably possess the shortest maxillaries. Another conspicuous nuptial development concerns the anal fin. The base of this fin in the spawning male becomes lengthened by about half its original basal length (although the radial length appears actually to shorten slightly). At the base of the first anal rays a double series of enlarged, imbricated scales partially conceals this portion of the fin. These peculiar scales in reality are free cuticular outgrowths on the exposed surface of the underlying true scales. This nuptial transformation may occur at different ages, as evidenced by a male two and three-quarters of an inch long from Lake Biwa (one year old) and our No. 43 from Mikawa Bay in its third year.

In an article published in Japanese a few years ago by Professor T. Kagiya the writer states that it is usual for the *Ayu* to mature, spawn, and die in its first year. We have made a careful study of scales from several of the above *Ayu* from different localities in Japan with reference to age. Our diagnosis was corroborated by Mr. Hubbs. For nine typical fish the results were as follows: in the first year, one; in second year, two; in third year, five; in fourth year, one. Nothing resembling the spawning-mark of trout was seen in any of our scales. This suggests the occurrence of but one spawning for the *Ayu*, followed by the death of the individual as in *Oncorhynchus*.

Following is a condensed translation by M. Kasawa, of Professor Kagiya's account of the life-history of the *Ayu*, in Japan:

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[31] Percentage of total length of fish.

"The Ayu is strictly a river-fish. The spawning, which covers a period of about two months, takes place in August and September. The actual locations chosen for spawning are clear pools between one and two feet deep, with sandy bottoms, near the bank of the stream. The females average about 50,000 ova, and these are deposited in the sand on the bottom, usually during late afternoon or evening.

"The eggs hatch in about three weeks and the young fish migrate downstream to brackish water (about late September and October) where they remain about two months. Following the feeding period in the estuary, by which time they have grown to about two or three inches, they again migrate far up to the headwaters. Here in the cold clear tributaries they feed on diatoms, moss, and other aquatic plants through the spring and summer; and grow to maturity. The ascending Ayu are called *Nobori Ayu.*

"With the advent of late summer the development, both as to size and sexual maturity, is greatly hastened. Preparatory to spawning the mature fish undergo a downstream migration to their spawning grounds in the middle reaches of the river. These mature migrating fish are called the *Kudadi Ayu* or *Descending Ayu.* The ripe fish take on a rusty color just before spawning time.

"Nearly all the adult fish die after spawning, but the writer believes that a small number survive and persist another year. To these alleged survivors the name *Tomari Ayu* (*Remaining Ayu*) is applied.

"There is great mortality among the young Ayu, especially following hatching, due to the activity of predatory species of catfish, carp, and other dace.

"The Ayu occasionally reaches the length of a foot or more and a weight of one and one-quarter pound. It does not occur in Hokkaido.

"In a recent season six provinces marketed Ayu with an aggregate value of 167,000 yen." ($83,500).

It is a singular fact, that abundant as are the *Coregonidæ* and *Thymallidæ* in Eastern Siberia, no specimen of either family has been found in Japan.

Family OSMERIDÆ.

78. [129] **Osmerus dentex** Steindachner. *Kyuri-uwo* = Cucumber-fish.

One specimen from Kushiro, Hokkaido. (Tanaka.)

79. [129A] **Spirinchus lanceolatus** (Hikida).

Osmerus dentex Franz, Abh. Bayer. Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 6, pl. 3, fig. 5 (not of Steindachner), young, from Misaki.

Osmerus lanceolatus Hikida, Zoöl. Mag., XXV, 1913, p. 127, pl.

We have not seen Hikida's description (which we quote from the Zoölogical Record), but have a specimen labelled "*Osmerus lanceolatus*," a nuptial male, 134 mm. long to caudal fin, from Iburi, Hokkaido, presented to Dr. Jordan by Dr. Tamiji Kawamura. It undoubtedly belongs to the genus *Spirinchus* Jordan and Evermann. Five other specimens, representing both sexes in the breeding condition, were taken in Kushiro by Tanaka.

The characters of *Spirinchus lanceolatus* are as follows: Dorsal rays, 2, 8 (2, 9 in one specimen); anal rays, 4, 16 (3 or 4, 15 or 16); pectorals, 11 (11 or 12); ventrals, 8 (constant); scales 7–62 to 65–8 to 10; length of head to end of opercular membrane, 4.35 (4.4 to 4.6) in length to caudal base; depth of body, 5.3 (to 5.4 in males; 4.65 to 5.0 in ripe females); least depth of caudal peduncle, 3.0 in head (3.0 to 3.2); snout, 4.5 (4.4 to 4.6); upper jaw, 2.1 (2.0 to 2.15) not longer in male than in female; mandible, 1.95 (1.8 to 2.0); orbit, 4.5 (4.2 to 4.6); eye 5.6 in breeding male, larger in females; fleshy interorbital, 3.35 (male); bony interorbital, 4.6 (4.2 to 4.7). Body of breeding male oblong, the greatest depth being almost evenly maintained from the shoulders to the anal fin, behind which point the ventral contour rises rather sharply to the fairly slender caudal peduncle; females more trimly formed. In both sexes the head is rather massive, and blunt anteriorly; ventral contour curved rather sharply upward to tip of the projecting mandible; dorsal contour much flatter, weakly concave behind eyes, but a little convex on snout. Tip of mandible on level of middle of eye, tip of premaxillaries somewhat higher. Interorbital space weakly convex; suborbital narrower than the upper jaw, which has a concave upper border and a tip more rounded dorsally than ventrally; maxillary extending to below posterior border of eye. Branchiostegals 4–3; gill-rakers, 11+26=37, the longest, 1.6 in orbit. Pyloric cœca four, of very unequal length. Teeth weak for a Smelt; tongue covered with strong, but rather short, teeth, of which four or five around the tip are somewhat enlarged, scarcely canine-like. Other teeth arranged in single file, those of premaxillary and mandible of moderate size, rather close-set; those of maxillary very fine; those of vomer, palatines, and pterygoids very small canines; each side of the vomer and each palatine bone with four or five of these teeth.

Breeding males are all very dark in color, dusky above the blackish lateral stripe, which extends along and just above the lateral line; scale-margins ventrally dark; top of head dark, becoming blackish on the snout, rest of head heavily punctate with black; dorsal fin dusky, blackish on the front edge; adipose pale; caudal blackish throughout; anal black on basal half; ventrals dusky, with dark specks medially; pectorals dark, blackish on upper border. Females pale in color, showing the same markings.

In the breeding male the entire head and body, and both sides of all the fins except the caudal and adipose are thickly covered with small warty pearl-organs, not represented in the females, even by rudiments. The skin is everywhere turgid, the scales being particularly soft and thick. The lower fins are greatly expanded and lengthened in the breeding male; the pectorals reaching to within less than the length of the eye from the insertion of the ventral fins, which in turn extend to (or nearly to) the origin of the anal, each fin being nearly as long as the head; the anal, when depressed, reaches to the root of the lower caudal rays, and its longest rays are contained 1.6 to 1.7 times in the head. The membranes of these lower fins are widened and the rays thickened, so that the fins are spread in fan-like fashion. In the females each of the lower fins falls short of the next fin by a distance about equal to the length of the eye, and the highest anal ray is only two-fifths as long as the head. Our breeding males are 134 to 148 mm. long to caudal fin; ripe females 129 to 136 mm.

Genus Hypomesus Gill.

The generic name *Hypomesus* Gill under the present rules should be adopted in preference to *Mesopus* Gill, given to the same group on the preceding page, but left as a typographical error (failure to completely correct proof).

80. [130] **Hypomesus olidus** (Pallas). *Wakasagi* = Pond-smelt.

Lake Kawaguchi, (Masashi Ishikawa); Lake Yamanaka (near Fuji-san); Nagano (Nakano); Lake Suwa (Ota); Lake Suwa (Jordan); Lake Mikata; Fukui, Akita, Aomori, (Beppu); Iwate (Awaya); Lake Kasumigaura (Hattori).

It is not entirely clear that *Salmo inghaghitsch* Walbaum can be identified with this species, for which Pallas' name *olidus* may apparently be retained.

Hypomesus olidus differs sharply from *Hypomesus pretiosus* of California in the smaller size of the scales (there being fifty-four to sixty-two rather than about seventy in the course of the lateral line); in the more anterior position of the ventral fins in reference to the dorsal, the ventral insertion being usually in advance of, instead of a little behind, the vertical from the origin of the dorsal; in the much larger size of all the fins; in the darker color; and in the habit of spawning in fresh-water ponds, rather than in the surf of the sea.

The other species known from Japan, *Hypomesus japonicus* (*Osmerus oligodon* Kner), differs from *H. olidus* and resembles *H. pretiosus* in all of the characters listed above, with the exception of the size of the scales, which is intermediate, and possibly of the breeding habits, which have not been recorded for *H. japonicus*.

Hypomesus olidus and *H. pretiosus* agree with one another and with the species of *Osmerus* and *Plecoglossus* in having the head, body, and fins in the breeding male almost completely covered with minute warty pearl-organs, and the fins thickened and enlarged.

H. olidus ranges from the lakes of central Japan northward through Kamchatka and southern Alaska to the Arctic shores of North America.

We have compared series from the different lakes of Japan, but fail to find any consistent differences. The dorsal rays vary from 8 to 10, of which 2 or 3 are simple; the anal rays from 15 to 18, 3 or 4 unbranched; the scales along lateral line to caudal base, from 54 to 62. Our largest male is 126 mm. long to the caudal fin; the largest female, 113 mm. long. The specimens from the southernmost locality, Lake Suwa, are dwarfed, but not otherwise different.

We may note here that the records of *Osmerus thaleichthys* from the Nushagak River, Alaska, which have several times appeared in reports[35] refer to the present species, as we have determined by a re-examination of the material involved. *Spirinchus thaleichthys* is therefore to be eliminated from the lists of Alaskan fishes.

81. [131] **Hypomesus japonicus** (Brevoort).

We identify with this species two specimens taken by Tanaka at Kushiro, Hokkaido.

Dorsal rays, 10 (two simple); anal, 14 or 15 (three unbranched); the last ray counted as branched from base. Scales to caudal base, 66 to 68. Ventral fin inserted a little behind the dorsal origin.

Hypomesus japonicus seems to be most closely related to *H. pretiosus*, with which it is compared in the account of the preceding species. It is probably the western representative of that form ranging from Japan northward to Kamchatka. Material from the latter region (collected at Petropavlovsk) was erroneously identified by Jordan and Gilbert[36] with *Mesopus olidus*.

Family ARGENTINIDÆ.

82. [133] **Argentina semifasciata** Kishinouye. *Nigisu* = Second Gisu.

Toyama; Noo, (Niigata).

Our seven specimens are all from the Sea of Japan.

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[35] Gilbert, Rept. U. S. Fish Comm., 1893, (1895), p. 400.—Jordan and Evermann, Bull. U. S. N. M., XLVII, pt. 1, 1896, p. 522.—Jordan and Gilbert, Rept. Fur Seal Inves., III, 1898, p. 440.—Evermann and Goldsborough, Bull. Bur. Fish., XXVI, 1906 (1907), p. 40 (not figure).

[36] Rept. Fur Seal Invest., III, 1898, p. 440.

Family SALANGIDÆ.

83. [135] **Salangichthys microdon** (Bleeker).[37] *Shira-uwo* = White-fish.
Aomori (Beppu); Lake Kasumigaura (Hattori); Yamada (Tsuchiga).

84. [136] **Parasalanx ariakensis** (Kishinouye).

By re-examining the paratype of this species we are able to confirm Oshima's[38] reference of this species to *Parasalanx*.

85. [Extraterr.] **Hemisalanx prognathos** Regan.

A breeding pair received from Soo-chow, China (Gee).

Family GONORHYNCHIDÆ.

86. [137] **Gonorhynchus abbreviatus** Temminck and Schlegel.
Nezumi-gisu = Rat-Gisu.

One specimen, Mikawa Bay (M. Ishikawa).

Head, 4.25 in length to caudal; depth, 8.7; pectoral fin, 5.7. Eye, 4.65 in head; snout, 2.45; interorbital, 4.25. Dorsal rays, 2.8; anal, 2.6; scales, 21–166–16.

Family AULOPIDÆ.

87. [138] **Hime japonica** (Günther). *Hime* = Princess.

Ten specimens from Misaki (Aoki).

The species, hitherto called *Aulopus japonicus*, differs from *Aulopus* in important respects, and is the type of the genus *Hime* Starks. (Copeia, March 29, 1924, p. 30.)

Family ASTRONESTHIDÆ.

88. [144] **Astronesthes iijimai** Tanaka. *Tokage-hadaka* = Naked Lizard.

We have fourteen specimens of this deep-sea fish, collected by Owston in the Sagami Sea, and eleven taken by Aoki at Misaki.

The species needs to be compared with the Indian *A. martensi* and the Hawaiian *A. lucifer*.

The photophores in our material of *Astronesthes iijimai* vary as follows: operculars 2; branchiostegals 18 to 21; jugulars 8; upper thoracics (to ventral fin) 18 or 19; lower thoracics 22, the third and fourth opposite the pectoral bases; upper ventrals, 21 or 22, a few overlapping the front of anal base; the lower ventrals 21 to 23, 4 (rarely 3) opposite or before ventral bases, the last 2 opposite anal base (counted by Gilbert and Tanaka as the first two of the anal series); anals 7 or 8, the last one to four variously elevated; caudals 4 or 5.

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[37] We have not compared our material with the descriptions (in Japanese) of *Salangichthys kishinouyei* and *S. ishikawæ* Wakiya and Takahashi (Zoöl. Mag., XXV, 1913, pp. 551–555).

[38] Ann. Car. Mus., XII, 1919, p. 174.

Family MAUROLICIDÆ.

89. [145] **Maurolicus pennanti** (Walbaum).[39] *Kyuri* = Cucumber.

Five specimens from Toyama, Sea of Japan, (Yoshizawa).

We find the following photophores present in these examples: one before and one behind middle of eye; one before and one behind preopercular angle; six in branchiostegal series; one on chin (on each side); six on isthmus; nine of irregular shape in the series from pectoral base to above anal origin; twelve from isthmus to ventral fin; two behind ventral fin, and then a series of four from between these to anal origin; one above anal origin over the gap between the ventral and anal series; fourteen to sixteen anals, the last narrowly separated from first of the eight or nine paired postanals; last postanal median.

Two specimens from the Mediterranean Sea at Messina agree exactly in the number and arrangement of the photophores.

Family SYNODONTIDÆ.

90. [151A] **Synodus fuscus** Tanaka.

Tanaka has lately described three new species of *Synodus* from Japan.[40] From a translation of his paper and a study of one specimen of *S. fuscus* we have prepared the following:

KEY TO THE JAPANESE SPECIES OF SYNODUS.

- *a.* Scales relatively small, about 65 in lateral line . . . . *japonicus.*
- *aa.* Scales larger, 45 to 55 in lateral line.
  - *b.* Eye much shorter than the sharp snout, about 6 to 7 in head; dorsal, 11 or 12; anal 9 or 10. *fuscus.*
  - *bb.* Eye about as long as snout, 4 to 4.5 in head.
    - *c.* Dorsal rays, 12; anal, 11; scales, 52 . . . . *macrops.*
    - *cc.* Dorsal rays, 13; anal, 9; scales, 55 . . . . *hoshinonis.*

The following is the substance of the original description of *Synodus fuscus*: Head, 3.5; depth, 7; eye, 6.25; interorbital width, 6; snout, 3.8; depth of caudal peduncle, 6. Dorsal rays, 11; anal rays, 10; pectoral, 12; ventral, 8. Scales 3.5–53–5.5. Snout about half longer than the eye. Ventral fin inserted a little in advance of dorsal origin; tip of pectoral reaching ventral insertion; caudal emarginate. Color greenish, the lower side whitish, marked on the sides with nine indistinct blotches; dorsal also marked; pectoral dark, ventral and anal white; margin of caudal dark. Tokyo market.

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[39] We do not have at hand the description of *Maurolicus japonicus* Ishikawa (Jour. Coll. Agric., VI, 1915, pp. 183–191, 2 pls.).

[40] Zoöl. Mag., XXIX, No. 340, 1916, pp. 37–38.

Our single specimen of *Synodus fuscus* (collected by Masashi Ishikawa in the Bay of Mikawa) shows the following characters: Head, 3.8; depth, 7.4; eye, 6.6; interorbital, 8.5; snout, 4.0; depth of caudal peduncle, 5.6. Dorsal, 12; anal, 9; scales 4–52–6.

91. [148A] **Saurida grandisquamis** Günther.

Saurida grandisquamis Günther, Cat. Fishes Brit. Mus., V, 1864, p. 400, (Louisiades, Günther) Fische der Südsee, III, 1909, p. 377.—Weber and de Beaufort, Fishes Indo-Austral. Arch., II, 1913, p. 141.—Fowler and Bean, Proc. U. S. N. M., LXII, 1922, 3 (Sept.).

Saurida macrolepis Tanaka, Zoöl. Mag., XXIX, 1916, 39.

Tanaka's account of *Saurida macrolepis* agrees so well with the descriptions of *Saurida grandisquamis* noted above, that we accept the two as probably identical. The specimens described by Fowler and Bean came from Formosa.

92. [149] **Saurida argyrophanes** (Richardson). *Eso.*

Misaki (Aoki); Kagoshima Bay (Wakiya); Tokyo and Kobe markets (Jordan).

Scales 48 to 52 between gill-opening and end of last vertebra. Pectoral fin reaching to above insertion of ventral. Adipose eyelid not very wide or thick.

93. [150] **Saurida eso** Jordan and Herre. *Tokage-eso* = Lizard-Eso.

Tokyo and Kobe markets (Jordan); Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa); Miyazu, Noo. We have also examined a specimen of this species collected by the late Professor Walter Fong at Hong Kong, China.

Scales 5 or 6—61 to 63 (to caudal base)—7.

Weber and de Beaufort[41] refer both *S. argyrophanes* and *S. eso* to the synonymy of *Saurida tumbil* (Bloch). We are not prepared to identify either of these Chinese-Japanese species with *S. tumbil,* and are certain that they differ from one another. *Saurida eso* has the scales constantly smaller; the pectoral fin shorter, not reaching the ventral insertion; and the adipose eyelid wider and thicker. It also attains a larger size.

This important species is valued in the preparation of "kamoboku."

94. [152] **Trachinocephalus myops** (Forster). *Oki-eso* = Off-shore Eso.

Toba market (Jordan and Yamamoto); Tokyo and Kobe markets (Jordan); Mikawa Bay (M. Ishikawa); Miyazu, Misaki (Aoki).

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[41] The Fishes of the Indo-Australian Archipelago, II, 1913, p. 142.

Family MYCTOPHIDÆ.

95. **Diaphus latus** Gilbert.

Diaphus latus Gilbert, Mem. Car. Mus., VI, 1913, 95, pl. XIII, fig. 1.

This species may provisionally be retained in the genus *Diaphus*, pending a comparative study of the known species.

Three specimens were obtained at Misaki (Aoki).

The photophores are like those of the type in all essential respects, the only significant deviations affecting the anals. First anal as near as, or not much farther from, the second than is the third, the interspace being decidedly less than that between third and fifth organs of the series; last antero-anal but little elevated on one side of one specimen.

Genus Lamprossa Jordan and Hubbs gen. nov.

This genus agrees with *Diaphus*, as now restricted, in all essential respects, except the development of light organs about the eye. These are well described by Gilbert as follows:

"A well-developed supra-orbital luminous body, ... in the form of a narrow streak along the upper border of the orbit, not extending behind the pupil; a small superior pre-orbital, in its usual position above the nostril; a third luminous body occupying the position of both suborbital and inferior preorbital, extending on the inferior border of the eye to, or beyond, the middle of the orbit, becoming abruptly narrowed beneath front of eye and sending a narrow upward extension nearly to level of the superior pre-orbital."

Type: *Diaphus anteorbitalis* Gilbert.

A Hawaiian species, *Diaphus adenomus* Gilbert, approaches *Lamprossa* in the development of orbital photophores, and may for the present be referred to this genus.

96. [156B] **Lamprossa anteorbitalis** (Gilbert).

Diaphus anteorbitalis Gilbert, Mem. Car. Mus., VI, 1913, p. 92, pl. XII, fig. 1.

Six specimens were taken by Aoki at Misaki. They agree well with the types in the disposition and number of the photophores, the only point of deviation being the height of the first antero-anal. This photophore may occupy any position between the horizontals from the lower and the middle supero-anals.

Genus Pantophos Jordan and Hubbs, gen. nov.

We separate this genus from *Diaphus*, as the type species has glandular bodies connected not only with the suprapectoral photophore, but also with nearly all of the other light-organs on the side of the body. The antorbital photophore is confined to a cavity above the nostril, and is directed forward, as in several species of *Diaphus*, but there is also characteristically developed a large suborbital photophore, located on the lower orbital margin.

The type species, *Diaphus glandulifer* Gilbert, alone is known.

97. [156C] **Pantophos glandulifer** (Gilbert.)

Diaphus glandulifer Gilbert, Mem. Car. Mus., VI, 1913, p. 90, pl. XI, fig. 2.

One specimen from Misaki, (Aoki).

Dorsal rays, 15; anal, 16; pectoral, 11 or 12; ventral, 8; scales, 36; head .29 and eye .08 of total length. Photophores arranged exactly as indicated by Gilbert, and of the same number, with the exception that there are six postero-anals on one side.

98. [159A] **Nyctimaster jordani** (Gilbert).

Type from the east coast of the Hokkaido.

Family ARIIDÆ.

99. [162A] **Netuma osakæ** Jordan and Kasawa, sp. nov.

(Plate IX. Fig. 1.)

Type, a specimen 37.5 cm. long to caudal fin, found by Jordan and Yamamoto in the fish-market at Osaka (Car. Mus. Cat. Fishes, No. 7808.)

This species differs widely from the common East Indian form, *Netuma thalassina*, the only species hitherto recognized in the genus, in having the top of the head covered with smooth skin, the granular bony area being chiefly restricted to the median portion of the occipital process. The snout is more bluntly rounded, when viewed from above, in *N. osakæ*, and the body is a little deeper, although the caudal peduncle is slenderer; the fins are lower. The differences in proportion are indicated by the following comparison of the type of *N. osakæ* with a Philippine specimen of *N. thalassina* of comparable size.

	Netuma thalassina	*Netuma osakæ*
Width of granular area on occipital process in length of process	1.4	6.0
Length of snout in head	2.5	2.7
Depth of body in length	4.6	4.0
Depth of caudal peduncle	4.0	4.6
Length of dorsal spine in head	1.6	1.8
Length of longest dorsal ray in head	1.35	1.6
Length of longest anal ray	2.4	2.8
Length of ventral fin in head	1.5	2.1

This is the first Sea-catfish to be definitely recorded from Japan, Thunberg's type of *Silurus maculatus* (*Arius maculatus*) having perhaps come from China.

Body rather robust, highest at front of dorsal fin, wedge-shaped anteriorly to the snout, which is sharply pointed, when viewed from the side, but very broadly rounded, when viewed from above; behind the deepest point the contours are gently convex to the caudal peduncle, which is narrow medially, but abruptly expanded at base of caudal fin. Head 3.2 times in length to caudal; its width about two-thirds its length and one-fourth greater than its extreme depth, and much narrower than the body is deep (in *thalassina* width of head and depth of body about equal). Orbit 7 in head; greatest interorbital width 2.1. Top of head covered with smooth skin; weak granulations appearing only in a small patch on each side of occiput; occipital process granular medially, but its sides wholly smooth; the granulations become weak posteriorly toward the very small, smooth, basal plate at dorsal origin; interorbital space weakly arched, without the median depression found in *N. thalassina.* Maxillary barbels unequal, the left, when laid straight back, not reaching far beyond the vertical from posterior border of eye, right maxillary barbel extending a little beyond bony margin of opercles; outer mental barbels a little longer than inner ones, about as long as maxillary; posterior nostril with a pair of flaps along its hinder border, which are just covered by the large semi-circular flap arising between the two nostrils. Teeth all villiform, forming wide bands; premaxillary band arcuate and continuous; mandibular band more curved, and interrupted at symphysis. Vomer with a broad band made of two roundish subequal patches on each side; palatines with a longer posterior patch fitting into a broad notch between the two members of the vomerine set, its form triangular, prolonged backwards. Gill-membranes forming a wide fleshy fold; gill-rakers rather stiff, cylindrical, 6+6 in number, the longest one-third as long as eye. Dorsal spine rather obscurely granulate anteriorly (not granulate-serrate as in *thalassina*); adipose fin rather large, free; located above middle of anal base; anal fin falcate; caudal deeply forked, the upper lobe the longer and the more sharply pointed; pectoral spine about as long as dorsal spine, obscurely granulate on front margin, and weakly serrulate posteriorly.

Color rich brownish above, grayish white below; dorsal and anal fins pale brown; caudal fin brown, with a greenish tinge on the lobes; paired fins brown on upper surface, gray below.

Family PLOTOSIDÆ.

100. [163] **Plotosus anguillaris** (Forskål). *Umi-gigi* = Sea Gigi.

Misaki (Aoki); Mikawa Bay (M. Ishikawa); Wakanoura (Yamamoto); Toba market (Jordan and Yamamoto).

This species is annoyingly common along the shore of Kyūsyū.

Family SILURIDÆ.

101. [164] **Parasilurus asotus** (Linnæus). *Namazu* = Catfish.

Fresh water at Kumamoto (Wakiya); Ozu (Wakiya); Himeji (Abe); Nagano (Nakano); Lake Suwa (Ota); Lakes Suwa and Hakone (Jordan); Fukuoka (Hamada); Hino River, Lake Kasumigaura (Hattori).

This species is generally abundant in the quiet parts of streams in the southern half of Japan. It reaches a larger size than the other *Namazu* (Cat-fishes) of the rivers.

Dorsal rays 4 to 6; anal rays 72 to 83. The coloration varies from plain to brightly mottled, the sharpest contrasts appearing in a specimen from Himeji. The lateral lines are connected across the back by vertical branches, as indicated by Schlegel in his figure of *Silurus japonicus*.

Family BAGRIDÆ.

102. [165] **Pelteobagrus* nudiceps** (Sauvage). *Hage-gigi* = Bald Gigi.

Lake Biwa (Wakiya); Lake Biwa (Jordan); Himeji (Abe); Okayama (Mikamo).

Anal rays, including rudiments, from 18 to 23 in number.

The young are very coarsely blotched or vertically barred with pale areas, while the adults are uniformly marked, or streaked with two lengthwise light areas. In well preserved specimens the bones of the head are entirely covered with skin.

103. [Extraterr.] **Pelteobagrus fulvidraco** (Richardson).

A specimen collected by Gee at Soo-chow, China, has been sent to the Museum of Zoölogy, University of Michigan.

104. [166] **Pseudobagrus aurantiacus** (Temminck and Schlegel). *Gigi.*

Fukuoka (Hamada).

Like *Pelteobagrus nudiceps*, this species may be either coarsely blotched, or striped with light areas.

105. [167] **Liobagrus reini** Hilgendorf. *Akaza* = Red Cat-fish.

Himeji (Abe); Toyama (Yoshizawa); Lake Biwa (Jordan); Lake Kitagata, Fukui.

The variations in proportions in this little Cat-fish are very wide, but are not correlated with one another. We thus agree with Tanaka, that *Liobagrus sugubrii* Regan[42] cannot be recognized.

Interocular space, 2.45 to 3.0 in head; dorsal spine, 3.0 to 5.5; depth of body, 5.0 to 7.3 in length to caudal; pectoral spine varying from much less to much more than half the length of that fin.

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*The group called *Fluvidraco* by Jordan and Fowler apparently cannot be separated from *Pelteobagrus* Bleeker, based on *Silurus calvarius* Basilewsky.

[42] Ann. Mag. Nat. Hist. (8) I, 1908, p. 152; Proc. Zoöl. Soc. London, 1908, p. 62.

Family COBITIDÆ.

106. [168] **Misgurnus anguillicaudatus** (Cantor). *Dojo* = Loach.

Nagano (Nakano); fresh water at Kumamoto (Wakiya); Himeji (Abe); Toyama (S. Yoshizawa); Noo, (Awaya); Lake Kasumigaura (Hattori); Lake Biwa at Otsu (Jordan and Kawamura); Lake Suwa (Jordan); Soo-chow (Gee).

Extremely common in streams and lakes. One of the Lake Biwa specimens has only nine barbels, there being but one on one side of the mandible.

107. [170] **Hymenophysa curta** (Temminck and Schlegel). *Umi-dojo* = Sea-loach.

Three specimens of this peculiar loach were collected in Lake Biwa at Otsu by Jordan and Kawamura.

108. [172] **Lefua echigonia** Jordan and Richardson.
Hotoke-dojo = Buddha-loach.

Lefua nikkonis Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 768, fig. 1 (specimens from Shimotsuke, near Nikko, but not the type from Chitose, Hokkaido).

Lefua echigonia Jordan and Richardson, Proc. U. S. N. M., XXXIII, 1907, p. 264, fig. 1.—Tanaka, Annot. Zoöl. Jap., VII, 1909, 129.

With some doubt we refer to this species two specimens from the Hiki River in Kishu, collected by H. Kuroiwa, and bearing the local name "*Hotoke-dojo.*" They differ from the type in their plain coloration, the spots on the body and fins being obsolescent, and in the slenderer build. The coloration is very variable, however, as Tanaka has indicated, and as we find in examining the specimens from Shimotsuke which Jordan and Fowler confused with their *L. nikkonis.* The difference in form seems to be largely due to the lesser deposition of fat, for the adipose folds on the caudal peduncle are not developed, and the whole texture is firmer; furthermore this variation is paralleled in other loaches, as in the common *Misgurnus.*

109. [174] **Cobitis biwæ** Jordan and Snyder. *Shima-dojo* = Striped Loach.

Kumamoto (Wakiya); Himeji (Abe); Okayama (Mikama); Lake Kasumigaura (Hattori); Noo, Lake Biwa at Otsu (Jordan and Kawamura).

We have not reconsidered the validity of this abundant species, which scarcely differs from *Cobitis tænia* of Europe.

Genus BARBATULA Linck.

The generic name *Barbatula* Linck, 1790, antedates and replaces *Oreias* Sauvage, 1874, and *Orthrias* Jordan and Fowler, 1903.

110. [173] **Barbatula oreas** (Jordan and Fowler). *Fuku-dojo* = Secondary Loach.

This species is not represented in the collections at hand.

Family CYPRINIDÆ.

111. [175] **Pseudoperilampus typus** Bleeker. *Zeni-tanago* = Genuine Chub.

Lake Kasumigaura (Hattori); Lake Biwa (Jordan).

Genus HEMIGRAMMOCYPRIS Fowler.

Hemigrammocypris FOWLER, Proc. Acad. Nat. Sci. Phila., LXII, 1910, p. 483. Type: *Hemigrammocypris rasborella* Fowler.

Brevigobio TANAKA, Dobutsu-gaku Zasshi, Tokyo, XXVIII, 1916, p. 102. Type: *Brevigobio kawabatœ* Tanaka, = *H. rasborella* Fowler.

"No barbels about mouth; pharyngeal teeth 3-rowed, 4, 4, 2–2, 4, 4; dorsal fin inserted nearer to base of caudal than to tip of snout; a sharp ventral keel between anus and origin of ventral; lateral line decurved, incomplete, running along lower part of body, ending near last ray of anal." (*Tanaka.*)

This genus is in many ways similar to *Rasbora,* a genus now comprising many species of southern Asia and the East Indies, but differs from that genus in having the abdomen sharply keeled, and in the normal structure of the lower jaw.

112. [176A] **Hemigrammocypris rasborella** Fowler. Proc. Acad. Nat. Sci., Phila., LXII, 1910, p. 483. (Japan.)

Brevigobio kawabatœ TANAKA, Dobutsu-gaku Zasshi, Tokyo, XXVIII, 1916, p. 102 (Lake Biwa); Fig. Desc. Fishes Japan, XXIV, 1916, p. 420, pl. 115, figs. 339, 340 (Lake Biwa, pond near Tsu in Ise).

Genus ACHEILOGNATHUS Bleeker.

We follow Jordan and Thompson[43] in our treatment of the fishes of this group.

113. [177] **Acheilognathus rhombea** (Temminck and Schlegel).
Kanehira = Flat-money.

Kumamoto (Wakiya); Fukuoka (Hamada).

The depth of the body in this minnow is highly variable, being contained from 2.2 to 2.8 times in the length of body to caudal base, increasing very irregularly with age. The branched rays in the dorsal fin vary from twelve to fourteen in number.

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[43] Mem. Car. Mus., VI, 1914, 217–227.

114. [179] **Acheilognathus limbata** (Temminck and Schlegel). *Bote.*

Kumamoto (Wakiya); Hamada (Wakiya); Himeji (Abe).

We identify our half-grown specimens (43 to 53 mm. long to caudal) with this species. The body is less elevated than in adults, being contained 2.6 to 2.7 times in the standard length. Some of the specimens of similar size from Funayado (reported by Jordan and Fowler) are as slender as these, while others are deeper. The increase in depth with age is obviously irregular, as in *A. rhombea.* In some of the specimens the lateral line appears to be variously incomplete. Teeth 5–5, smooth, or with distinct traces of plications on one of the teeth. Scales about 33. Anal fin sometimes black-margined.

115. [180] **Acheilognathus lanceolata** (Temminck and Schlegel).
Yari-tanago = Spear-chub.

Eleven specimens from Kumamoto, collected by Wakiya, fully agree with Jordan and Thompson's account of this species (*l. c.*, p. 224). In fin-formula the only variant has ten-branched anal rays. Thirteen others from Noo near Niigata are essentially similar. All have nine-branched anal rays, but three have nine-branched dorsal rays.

Teeth, 5–5, with rather wide grinding surfaces, but with at most bare traces of plications. Scales 34–37.

116. [180A] **Acheilognathus intermedia** (Temminck and Schlegel).

Bay of Mikawa (M. Ishikawa); Himeji (Abe); Lake Mikata, Lake Kasumiguara (Hattori); Lake Biwa, at Otsu (Jordan and Kawamura); tributary of the Sumida River near Tokyo (Jordan).

We follow Jordan and Thompson (pp. 223–227) in the identification of this species.

The barbel varies considerably in length, being usually more than two-thirds as long as the snout; it is contained 1.0 to 1.7 times in length of snout. The branched fin-rays are: dorsal, 9 (8 to 10); anal, 10 (9 to 11). Scales to caudal base, 35 to 36. Pharyngeal teeth, 5–5, with wide grinding surfaces, but no plications.

117. [181] **Acheilognathus cyanostigma** (Jordan and Fowler).

Lake Mikata near Fukui; Lake Biwa at Otsu (Jordan and Kawamura).

Branched rays of dorsal, 8; of anal, 7 to 9.

118. [181A] **Acheilognathus tabira** (Jordan and Thompson). *Tabira* = Rice-chub.

Acheilognathus limbata Tanaka, Annot. Zoöl. Jap., VII, 1909, p. 133 (not of Temminck and Schlegel).

Acheilognathus tabira JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, p. 220, pl. XXV, fig. 1.

Nagano (Nakano); Fukuoka (Hamada); Lake Mikata, Lake Biwa at Otsu (Jordan and Kawamura).

The branched dorsal rays vary from 10 to 12; anal, 9 to 10.

119. [183A] **Rhodeus kurumeus** Jordan and Thompson.

Rhodeus kurumeus JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, p. 229, pl. XXVI, fig. 2.

Two small specimens of this species were collected by Wakiya at Kumamoto, not far from the type-locality, Kurume.

Half-grown specimens show two dark blotches on the front of the dorsal fin, one near the base, the other near its tip.

The depth of the type was given as 2.75, which appears to be a misprint for 2.25.

This species needs to be compared with the Chinese *Rhodeus ocellatus*.

Genus GNATHOPOGON Bleeker.

Jordan and Thompson[44] have given a very useful revision of the species of this genus, of which *Leucogobio* Günther, *Squalidus* Dybowsky, and *Otakia* Jordan and Snyder are synonyms. We have a large amount of new material from Japan and Korea, and find it necessary to go over the group again.

KEY TO THE KNOWN SPECIES OF GNATHOPOGON.

a. Anus not in advance of the normal position just before the anal fin. Eye small, usually less than one-fourth length of head. Pectoral fin usually reaching less than two-thirds the distance to ventral insertion.

- *b.* Snout narrower; maxillary reaching nearly or quite to below front of orbit. Pharyngeals with 2 or 3 teeth in inner row.
  - *c.* Pharyngeal teeth smooth or obsolescently serrate on the grinding surface (character not definitely described for the Asiatic species, group *dd*); barbel about as long as, or longer than pupil.
    - *d.* Barbel much longer than pupil (1.2 to 1.7 in eye). Origin of dorsal usually nearer base of caudal than tip of snout. Scales in four to five rows above, and 34 to 39 rows along the lateral line.
      - *e.* Body rather robust, its depth 3.4 to 4.3 in standard length; caudal peduncle less than twice as long as deep, its depth 7.4 to 8.7 in body; width of body about 1.75 in its depth. Length of pectoral fin 1.4 to 1.7 in distance between insertions of paired fins. Color lighter; less spotted. Lake Biwa to Kyūsyū..*elongatus.*
      - *ee.* Body slenderer, its depth 4.0 to 4.7 in standard length; caudal peduncle about twice as long as deep, its depth 8.6 to 10 in body length; width of body about 1.5 in its depth. Length of pectoral fin 1.6 to 1.9 in distance between origin of paired fins. Color darker; more spotted. Lake Suwa and adjacent waters.....................................*suwæ.*

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[44] Mem. Car. Mus., VI, 1914, pp. 214–217.

dd. Barbel scarcely as long as pupil. Origin of dorsal equidistant between tip of snout and caudal base. Caudal peduncle less than twice as long as deep. Asiatic mainland.

f. Scales in 6 rows above and 40 along lateral line. Headwaters of the Yangtsekiang. *tæniatus.*[45]

ff. Scales in 6 rows above and 36 along lateral line. Amur basin............*tæniatus* Berg. (? not of Günther.[46])

fff. Scales in 4 or 5 rows above and 36 to 38 along lateral line. Korea..........*strigatus.*[47]

cc. Pharyngeal teeth strongly dentate on grinding surface; barbel much shorter than pupil; body slender; origin of dorsal nearer tip of snout than base of caudal. Scales in 42 rows to caudal base. Lake Biwa and Yodo River, Japan..................................*cærulescens.*

bb. Snout broader and shorter; the maxillary only reaching to below middle of snout. Pharyngeals with only one tooth in the inner row. Origin of dorsal nearer tip of snout than base of caudal. China..*herzensteini.*[48]

aa. Anus in advance of normal position just before anal fin. Eye usually large, more than one-fourth length of head, except in large specimens of *G. japonicus.* Pectoral fin usually reaching more than two-thirds distance to ventral insertion. Origin of dorsal nearer tip of snout than base of caudal.

g. Distance from anus to anal fin less than length of eye.

h. Scales above lateral line in 2.5 to 3.5 rows; scales more or less enlarged on mid-dorsal line. Body with conspicuous dark spots; top of head spotted.

i. Barbel minute, about one-sixth as long as pupil. Scales above lateral line in 3 or 3.5 rows; scales of mid-dorsal line little enlarged. Ping-yang River, Korea. *majimæ.*

ii. Barbel about two-thirds as long as eye. Scales above lateral line in 3.5 rows; scales of mid-dorsal line moderately enlarged. Kyūsyū..............*gracilis.*

iii. Barbel longer than eye, but not reaching to below hind border of eye. Scales above lateral line in 2.5 rows; scales of mid-dorsal line much enlarged. Head 3.45, eye, 3.4, scarcely shorter than snout, longer than interorbital, 1.4 in postorbital. Ping-yang River, northwestern Korea......................*longifilis.*

hh. Scales above lateral line in 4 rows; (enlargement of scales on mid-dorsal line not described). Body with dark spots; top of head spotted. Barbel at least as long as eye, reaching to below hind margin of eye. Head, 4.0; eye, 3.5 to 3.6, shorter than snout, shorter than interorbital, about 1.5 in postorbital. River Sambu, southern Korea..*coreanus.*[49]

hhh. Scales above lateral line in 4.5 or 5 rows; scales not enlarged along mid-dorsal line. Body with dark spots, inconspicuous; top of head not spotted.

j. Barbel nearly as long as eye, but scarcely reaching to below hind border of pupil. Head, 3.7. Eye large, 3.15 in head, as long as snout, longer than interorbital, nearly as long as postorbital. River Ping-yang............*tsukhigæ.*

jj. Barbel short, not reaching to below middle of pupil, 0.3 to 0.6 as long as eye.

k. Eye 3.5 longer than snout or interorbital, 1.4 in postorbital. Scales 34 to 36. Chanka Lake, Amur basin...............................*chankanensis.*[50]

kk. Eye about 4.0 shorter than snout, little more than half postorbital. Scales 35 to 37. Streams of southern Japan.........................*japonicus.*

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[45] Günther, Ann. Mus. Zoöl., Acad. Imp. Sci. Petersb., 1896, p. 214, pl. 2, fig. A.

[46] Berg, Ichth. Amur., 1907, p. 84.

[47] Regan, Proc. Zoöl. Soc. London, 1908, p. 59, Chong-ju, Chung-Chong Province, Korea.

[48] Günther, *l. c.*, p. 213, pl. 2, fig. B.

[49] Berg, Ann. Mag. Nat. Hist., (7) XVIII, 1906, p. 394.

[50] Dybowsky, Verh. Zoöl. Bot. Ges. Wien, XXII, 1872, p. 215; Berg, Ichth. Amur., 1909, p. 83.

gg. Distance from anus to anal fin at least as long, usually longer, than diameter of the large eye. Depth of body 4.5 to 6.0 in length.

l. Scales above lateral line in 4 rows, along lateral line in 33 rows. Head more than one-fourth the standard length. Formosa . . . . *iijimæ.*[51]

ll. Scales above lateral line in 5 rows, along lateral line in 39 rows. Head less than one-fourth standard length. Lake Biwa. Japan . . . . *biwæ.*[52]

120. [184 and 188] **Gnathopogon elongatus** (Temminck and Schlegel).

Moroko = Minnow.

Capoëta elongata Temminck and Schlegel, Fauna Jap., Pisces, 1846, p. 200, pl. 100, fig. 1.

Gnathopogon elongatus Bleeker, Ned. Tijdschr. Dierk., I, 1863, p. 202 (as type of *Gnathopogon*); Verh. Akad. Amsterdam, XVIII, 1879, p. 23.—Jordan and Snyder, Proc. U. S. N. M., XXIII, 1901, p. 343 (Lake Biwa); Annot. Zoöl. Jap., III, 1901, p. 47 (Lake Biwa).—Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 822 (Lake Biwa).—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 66.—Jordan and Thompson, Mem. Car. Mus., VI, 1914, pp. 215, 217 (Lake Biwa; Nagoya; Yodo River).

Barbus homogenes Günther, Cat. Fishes Brit. Mus., VII, 1868, p. 136 (after Schlegel; the name *elongatus* pre-occupied in *Barbus*).

Leucogobio guentheri Ishikawa, Annot. Zoöl. Jap., III, 1901, p. 161, pl. 3, fig. 1 (Matsubara on Lake Biwa).—Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 826 (Lake Biwa; Nagoya; Hatata; Chikugo River).—Berg, Ann. Mag. Nat. Hist., (7) XVIII, 1906, p. 395 (in key).—Tanaka, Annot. Zoöl. Jap., VII, 1908, p. 6 (Lake Biwa); Zoöl. Mag., No. 237, 1908, p. 235 (Lake Biwa).

Kachi River, at Nagoya (Jordan); Lake Biwa (Wakiya); Lake Kawaguchi, Mikawa Bay (M. Ishikawa); Himeji (Abe); Kumamoto (Wakiya); Ozu (Wakiya); Nagasaki.

Counts and measurements of a considerable series from various parts of Japan follow: head, 3.4 to 4.0 in standard length; depth of body, 3.4 to 4.3; depth of caudal peduncle, 7.4 to 8.7; eye, 4.2 to 5.0 in head, 1.2 to 1.7 times as long as barbel; pectoral fin contained 1.4 to 1.7 times in interval between insertions of paired fins; scales in lateral line to caudal base, 34 to 39; gill-rakers, *x* plus 6; teeth 5, 5–3, 5.

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[51] Oshima, Ann. Car. Mus., XII, 1919, 219, pl. LI, fig. 2, p. 128 (Tozeh River, Formosa); Proc. Acad. Nat. Sci. Phila., 1920, p. 125 (Rihikuton, Formosa).

[52] Berg, *l. c.*, 1909, p. 84, *footnote*, indicates the existence in Lake Chanka of a second and unnamed species, which he regards as related to *G. biwæ*.

121. **Gnathopogon suwæ** Jordan and Hubbs, sp. nov.

Type, 72 mm. long to caudal base, collected by Jordan in Lake Suwa, at Kamisuwa in Shinshu (Car. Mus. Cat. of Fishes No. 7814).

Eight paratypes were taken with the type; five other paratypes were taken in Lake Kisaki by T. Ota.

This species seems to be the local representative of *Gnathopogon elongatus*, which is widely spread to the southward. It also bears a fairly close resemblance to several species of the Asiatic mainland. It is compared with these and other species in the key, which has been given.

Form moderately trim, heaviest forward; the nape slightly elevated; width of body about two-thirds the depth, which is contained 4.2 (4.0 to 4.7) times in standard length; length of the rather slender caudal peduncle about twice its least depth, which measures 9.4 (8.6 to 10.0) times in length to caudal.

Head symmetrical, rounded anteriorly; its length, with opercular membrane, contained 3.8 (3.7 to 4.0) times in length to caudal; eye round and rather small, being contained 4.7 (4.4 to 5.0) times in head; decidedly shorter than either the snout or the convex interorbital, less than half the postorbital. Barbel well developed, but not long, reaching to below middle of eye; its length contained 1.4 (1.3 to 1.5) times in eye; upper jaw as long as snout, but being somewhat oblique, does not quite reach to below front of orbit; tip of premaxillaries on a level with lower part of pupil. Six gill-rakers on lower limb of arch, not counting extreme rudiments. Pharyngeal teeth more or less hooked, with grinding surfaces, which are at most obsoletely serrate; 4 or 5 teeth in the outer and 2 or 3 in the inner row. Peritoneum silvery, with clusters of black dots. Intestine shorter than body. Anus not advanced in position. Scales 4.5 to 5.5 between origin of dorsal fin and lateral line, 35 to 37 along lateral line to caudal base, 3 or 3.5 between lateral line and anal origin, and 3 to 4 between lateral line and ventral insertion. Dorsal rays, 2, 7 (rarely 6); anal, 2, 6; all fins short; pectoral extending much less than two-thirds distance to ventral, its length 1.75 (1.6 to 1.9) times in interval between origins of the two fins; ventral not reaching anus, extending only two-thirds to origin of anal; anal, when depressed, falling short of lower caudal rays by a distance longer than eye. Length of depressed dorsal contained 1.8 (1.6 to 1.8) times in distance from its origin to occiput. Origin of dorsal over ventral base, a little nearer base of caudal than tip of snout (sometimes almost equidistant).

Color grayish brown above, pale below. A dark stripe extends from the origin of the lateral line to the caudal base, becoming more distinct posteriorly, and running largely above the slightly decurved lateral line anteriorly. Dark spots of varying form and distinctness developed on the upper half of the body; most distinct in a paratype from Lake Kisaki.

122. [189, 198, and 203] **Gnathopogon cærulescens** (Sauvage).
Yanagi-moroko = Willow-minnow.

Squalius cœrulescens SAUVAGE, Bull. Soc. Philom. Paris, 1883, p.3 (Lake Biwa).

Leuciscus cœrulescens JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 845 (after Sauvage).

Otakia rasborina JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1900, p. 345, pl. 9, fig. 3 (Lake Biwa); Annot. Zoöl. Jap. III, 1901, p. 46 (Lake Biwa).—JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 842, fig. 6.—TANAKA, Zoöl. Mag., No. 237, 1908, p. 235.—JORDAN, TANAKA, and SNYDER, Annot. Zoöl. Jap., XXXIII, 1913, p. 70, fig. 44.

Leucogobio jordani ISHIKAWA, Annot. Zoöl. Jap., III, 1901, p. 163, pl. 3, fig. 2 (Lake Biwa).—JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 827 (after Ishikawa).—BERG, Ann. Mag. Nat. Hist., (7) XVIII, 1906, p. 395 (in key).—TANAKA, Zoöl. Mag., No. 237, 1908, p. 235, (Lake Biwa); *ibid.*, VII, 1908, p. 5 (Lake Biwa).—JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 67 (after Ishikawa).

Gnathopogon jordani JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, p. 217 (in key).

Lake Biwa (Wakiya, Jordan and Kawamura); Yodo River, outlet of Lake Biwa, at Kyoto (Jordan). We also have a series collected in Lake Biwa by Jordan and Snyder in 1900.

The species currently known as *Gnathopogon* (or *Leucogobio*) *jordani* fits the description of *Squalius cœrulescens* Sauvage in all respects. Sauvage makes no mention, however, of the minute barbel, but he obviously overlooked it. *Otakia rasborina* seems also to be the same, though the barbel is described as absent.

Jordan and Seale in 1906[53] recorded some minnow from Kawatana, near Nagasaki, under the name of *Leuciscus cœrulescens*, but we do not locate this material.

123. **Gnathopogon majimæ** Jordan and Hubbs, sp. nov.
(Plate IX; fig. 2.)

Type 43 mm. long to caudal fin, collected by Yōjirō Wakiya in the Ping-yang River, northwestern Korea; Car. Mus. Cat. of Fishes, No. 7816. The type is unique.

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[53] Proc. U. S. N. M., XXX, 1906, p. 144.

Body rather heavy forward, attenuate posteriorly; dorsal contour rising from tip of premaxillaries, which are on the level of lower border of pupil, in a convex curve to above front of orbit, thence nearly straight to occiput, beyond which it is considerably elevated. Greatest depth of body below the dorsal origin, more than twice the least depth, and contained 4.0 times in standard length. Head rather long and narrow, its dorsal contour more curved and more elevated than the ventral; length of head 3.35 in standard length; eye slightly oval and large, longer than snout or interorbital width, contained 1.3 times in postorbital, 3.0 times in head; interorbital flat; barbel slender and very short, only about one-sixth as long as the pupil, so short as to be hidden in the groove at angle of mouth, not reaching to below front of orbit; length of upper jaw equal to distance from tip of snout to the fold between nostrils; about seven rudimentary gill-rakers developed on lower limb of outer gill-arch; pharyngeal teeth 5–3, obscurely hooked, with entire grinding surfaces; peritoneum silvery, with black dots; intestine short; anus in advance of anal fin a distance nearly equal to length of eye. Scales large, 3 or 3.5 from origin of dorsal fin to lateral line; 2.5 from lateral line to insertion of ventral or origin of anal; eleven scales somewhat, but not greatly, enlarged, from dorsal fin to occiput; only thirty along lateral line to caudal base. Dorsal rays, 2.7; anal, 2.6. Fins all long; pectoral extending just to insertion of ventral, slightly more than two-thirds as long as head; ventral extending slightly beyond anus; the depressed anal reaching within scarcely more than half length of eye from lower caudal rays; dorsal especially elevated, its height being equal to its distance from occiput. Origin of dorsal slightly in advance of ventral insertion, a little nearer tip of snout than base of caudal.

Color pale, but with a deep brown band from front of snout to base of caudal, extending everywhere along the nearly straight lateral line, most intense on the snout, more or less interrupted at each scale margin. Top of head, and the back, but not the sides of the body, with numerous brown spots somewhat smaller than the pupil; the spots less distinct, as though more blurred, than in *G. longifilis.*

Named for Toyoji Majima of the Imperial University of the Hokkaido.

124. [185] **Gnathopogon gracilis** (Temminck and Schlegel).

Ito-moroko = Slim Minnow

Capoëta gracilis Temminck and Schlegel, Fauna Japonica, Pisces, 1846, p. 201, pl. 100, fig. 2 (Nagasaki).

Gnathopogon gracilis Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 23 (after Schlegel).—Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 823 (after Schlegel).

Barbus homozonus GÜNTHER, Cat. Fishes Brit. Mus., VII, 1868, p. 137 (after Schlegel; the name *gracilis* pre-occupied in *Barbus*).

Leucogobio mayedæ JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 828 (specimens from Chikugo River, and part of material from Lake Biwa; not *Gobio mayedæ* Jordan and Snyder).—JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 67 (in part; after Jordan and Fowler).

Gnathopogon ishikawæ JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, p. 215, pl. XXIV, fig. 4, (Chikugo River).

It appears almost certain to us that *Gnathopogon ishikawæ* Jordan and Thompson, rather than *Gobio biwæ* Jordan and Snyder, is identical with *Capoëta gracilis* Temminck and Schlegel. The figure of *C. gracilis* indicates a fish differing from *G. biwæ* in the lesser distance between anus and origin of anal fin; the deeper body, more elevated anteriorly, in the larger scales, etc. In these and other respects, except the height of the anal fin, which we find variable, the figure agrees with that of *G. ishikawæ.* Moreover the type-localities of *C. gracilis* and *G. ishikawæ* are in close proximity, while *G. biwæ* has only been taken in Lake Biwa, far to the northward.

The present collection contains no specimens of *G. gracilis,* but we have examined the type material of *G. ishikawæ.*

125. [Extraterr.] **Gnathopogon longifilis** Jordan and Hubbs, sp. nov.

Type, a fine specimen 49 mm. long to the caudal fin, collected by Yōjirō Wakiya in the Ping-yang River, northern Korea; Car. Mus. Cat. of Fishes, No. 7819. We have no paratypes.

The distinctive features of this form are indicated in our key. This species and *G. majimæ* bear a strong superficial resemblance respectively to *Notropis cayuga* and *Notropis heterodon,* which live together in weedy waters in the eastern United States. The similarity probably has an ecological basis.

The body is even more attenuate posteriorly and less elevated anteriorly, than in *Gnathopogon majimæ,* the whole form being trimmer. Greatest depth, considerably more than twice least depth, contained 4.45 times in standard length; nuchal elevation slight; dorsal profile of head rather gently decurved to tip of premaxillaries, which are scarcely higher than lower margin of eye. Head, 3.45; eye, 3.4; scarcely shorter than snout, a little longer than width of interorbital, 1.4 in postorbital; interorbital almost flat. Barbel long and slender, a little longer than eye, but not quite reaching to below posterior margin of orbit; maxillary reaching to below posterior nostril. Only five rudimentary gill-rakers developed on lower line. Pharyngeal teeth 5–3, obscurely hooked; almost smooth on grinding surfaces. Peritoneum silvery, but rather densely punctate. Intestine short. Anus in advance of anal fin a distance contained 1.4 times in the orbit. Scales large; 2.5 from origin of dorsal to lateral line; 2.5 from lateral line to insertion of ventral or origin of anal; 11 greatly widened from origin of dorsal to occiput; 34 along lateral line to caudal base. Dorsal rays, 2.7; anal, 2.6; fins all long; pectoral reaching almost to ventral, contained 1.3 times in head; ventrals slightly overlapping the anus; the anal when depressed, extends to within diameter of pupil from lower caudal rays. Height of the pointed dorsal fin a little greater than distance from dorsal origin to occiput; dorsal beginning considerably in advance of ventral insertion, diameter of one orbit nearer tip of snout than base of caudal.

Back light brown, with numerous rich deep brown spots, which are also traceable on top of head. The spotted back is abruptly marked off from the sides by a pale streak, which overlies the lateral stripe. The latter begins at the eye, not being developed on the snout, as in *G. majimæ*, and extends along the straight lateral line to the caudal base, being more or less interrupted at the scale margins.

126. [Extraterr.] **Gnathopogon tsuchigæ** Jordan and Hubbs, sp. nov.

Gnathopogon tsuchigæ is one of the three new species of the genus collected by Yōjirō Wakiya in the Ping-yang River, northern Korea. It is known only from the type, a specimen 69 mm. long to the caudal fin (Car. Mus. Cat. Fishes, No. 7818).

Body deepest slightly before the middle of its length, little elevated at either the nape or the dorsal origin; dorsal contour gently curved from dorsal fin to snout, where it is decurved almost to the horizontal from lower margin of orbit; greatest depth of body below dorsal origin a little more than twice the least depth, and contained 4.8 times in standard length; caudal peduncle twice as long as deep. Head rather heavy and deep, its length 3.7 in body; eye large and roundish, its upper edge almost flush with the flat surface of the interorbital, its length equal to that of snout, exceeding the interorbital width, as long as the postorbital exclusive of the opercular membrane and contained 3.15 times in head. Barbel slender, of moderate length, contained 1.3 times in the eye, but scarcely reaching to below posterior margin of pupil; upper jaw somewhat projecting and extending backward slightly behind vertical from posterior nostril. Gill-rakers less rudimentary than in related species, only five, however, below angle. Three teeth in lesser row (those of the outer row appear abnormal in the type, two being very broad, the third very slender and separated by a gap from one of the wider ones). Peritoneum finely punctate; intestine short; anus in advance of anal fin a distance nearly equal to length of the large eye. Scales moderate, 4.5 from origin of dorsal to lateral line, 2.5 from lateral line to ventral, 3 from lateral line to anal origin; about 13, not at all enlarged, from occiput to dorsal fin, 36 along lateral line to caudal base. Dorsal rays, 2.7; anal, 2, 6, as in related forms; pectoral fin one diameter of pupil shorter than interval between insertions of paired fins, which is equal to length of head; ventrals extending beyond anus, but not to anal fin, which, when depressed, reaches to within half of the diameter of orbit from caudal; length of the depressed dorsal scarcely shorter than occiput to dorsal; third dorsal ray over insertion of ventral, which is midway between tip of snout and base of caudal.

Color pale, with clusters of dots forming faint roundish spots in a series before dorsal fin, and in a series along the axial septum of the longitudinal muscles, the latter forming a chord across the curve made by the considerably decurved lateral line. Head without spots.

Named for Yasukei Tsuchiga, science-teacher at Yamada.

127. [190] **Gnathopogon japonicus** (Sauvage). *Deme-moroko* = Pop-eye Minnow.

Squalius japonicus SAUVAGE, Bull. Soc. Philom., 1883, p. 4, (Lake Biwa).

Leuciscus japonicus JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 845 (after Sauvage).

Gobio mayedæ JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1900, p. 342, pl. 9, fig. 2 (Lake Biwa); Annot. Zoöl. Jap. III, 1901, p. 46 (Lake Biwa).

Leucogobio mayedæ JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 828, fig. 3, (in part; see Jordan and Thompson, 1911).—BERG, Ann. Mag. Nat. Hist., (7), XVIII, 1906, p. 395 (in key).—TANAKA, Annot. Zoöl. Jap., VII, 1908, p. 5 (Lake Biwa); Zoöl. Mag., No. 237, 1908, p. 235 (Lake Biwa).—SNYDER, Proc. U. S. N M., XLII, 1912, p. 404 (Yamaguchi).—JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 67, fig. 41 (in part).

Gnathopogon mayedæ JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, pp. 215, 217 (Lake Biwa).

Lake Biwa (Wakiya). Kachi River at Nagoya (Jordan).

The species hitherto called *Gnathopogon mayedæ* is doubtless the one described by Sauvage as *Squalius japonicus*. As in the case of *G. cærulescens*, the small barbel was overlooked by Sauvage, and the species has been lately listed as a *Leuciscus*.

128. [191] **Gnathopogon biwæ** (Jordan and Snyder).

Gobio biwæ JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1900, p. 340, pl. 9, fig. 1 (Lake Biwa); Annot. Zoöl. Jap. III, 1901, p. 46 (Lake Biwa).

Leucogobio biwæ Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 829, fig. 4 (Lake Biwa).—Berg, Ann. Mag. Nat. Hist., (7) XVIII, 1906, p. 395 (in key).—Tanaka, Zoöl. Mag., No. 237, 1908, p. 235 (Lake Biwa).—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 68, fig. 42 (after Jordan and Snyder).

Gnathopogon gracilis Jordan and Thompson, Mem. Car. Mus., VI, 1914, pp. 214, 217, fig. 3 (Lake Biwa), not *Capoëta gracilis* Temminck and Schlegel.

This species is still known only from Lake Biwa. Jordan and Thompson made an unsuccessful effort to identify it with *Capoëta gracilis* Temminck and Schlegel, and in the same paper redescribed what appears to be the true *gracilis* as *Gnathopogon ishikawæ*.

129. [186] **Hemibarbus barbus** (Temminck and Schlegel). *Sai; Migoi* = Skin-carp.

Osaka and Tokyo markets (Jordan); Lake Suwa (Jordan); Nagano (Nakano); Hino River, Fukui; Lake Kasumigaura (Hattori).

Generally common southward in lakes and quiet streams.

One young specimen from Nagano, otherwise typical, has the body and head much darker than usual, and the spots on the body more numerous and darker. The normal coloration at different ages has been well described by Tanaka.[54]

We have not sufficient material from outside Japan to test the alleged identity of this species with *Hemibarbus labeo* of the Asiatic mainland.

Genus Belligobio Jordan and Hubbs, gen. nov.

Type: *Belligobio eristigma* Jordan and Hubbs.

Belligobio is related to *Hemibarbus*, but differs in having the last simple ray of the dorsal fin unossified, flexible, articulated, not a coarse bony spine, and in having the snout more produced. Both genera are related to *Gobio*, having scales of the same type.

Body elongate; head long, the snout sharply produced, longer than postorbital; a rather conspicuous flap between the nostrils; mouth very low, horizontal, chiefly lateral; upper lip normal, largely covered by the slightly projecting rostral fold; lower lip produced backward as a triangular median flap in contact with the gular groove; lower jaw entirely included; posterior maxillary barbels present, rather short, arising from lower edge of maxillary near its end; gill-rakers short but thick, four on lower limb of outer arch; pharyngeal teeth 5, 3, 1, the larger ones with a broad and deeply excavated grinding surface; bones of snout expanded, suborbitals, preopercle, and mandible with highly developed mucous cavities; dorsal fin with 7, anal with 6 branched rays; dorsal beginning a little before ventrals; anal far behind the dorsal; lateral line scarcely decurved, running on caudal peduncle a little below middle of depth.

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[54] Annot. Zoöl. Jap., VII, 1909, p. 131.

130. [186A] **Belligobio eristigma** Jordan and Hubbs, sp. nov.

(Plate IX; fig. 3.)

Type, an adult female, 118 mm. long to caudal, collected by Kumachichi Mikamo near Okayama (C. M. Cat. Fishes No. 7820.)

One paratype was taken with the type; another was collected by Abe at Himeji. Both of these localities are in the Inland Sea drainage of Hondo.

Head, 3.65 (3.45 in paratypes) in standard length; greatest depth of body, 4.9 (4.6 to 5.2). Least depth of caudal peduncle about 2.0 in its length, 3.15 (to 3.2) in head; snout, 2.3 (2.2); interorbital, 4.0 (to 3.8); postorbital, 2.55 (to 2.65); eye to end of fold of mouth, 4.0 (to 4.4); length of upper jaw, 4.3 (4.0 to 4.4).

Form rather slender, not particularly trim, the outlines not being even curves; body weakly compressed; snout much produced, considerably longer than postorbital; interorbital flat, bony, with three longitudinal ridges, of which the outer two diverge outwardly toward the nostrils. In preserved specimens a horizontal groove extends forward horizontally from below each nostril, joining its fellow in a wide curve, as viewed from above; anterior nostril with a raised rim, the posterior nostril with a fimbriate border; between the two there is a wide rounded flap, large enough to cover either nostril when depressed; extreme tip of snout abruptly decurved to form the rostral fold, which medially is on a level a pupil's length below eye, and which partially overhangs upper jaw. The moderately thick upper lip slightly overlaps the base of the barbel, which is inserted on the lower edge of maxillary near its end; barbel about two-thirds eye, extending slightly beyond vertical from hinder rim of posterior nostril; upper jaw a very little longer than eye, but not reaching to below the anterior nostril; gape largely lateral, very little oblique; lower lip moderately thick laterally, deflected backward from the symphyseal region to the gular groove as a flap one-fifth as long as the orbit, and having the shape of an isosceles triangle; gill-rakers rather large, but short and fleshy, angular in form, 2+4 in number; pharyngeal teeth triserial, 5, 3, 1, the larger ones with broad, deeply excavated grinding surfaces and little hooked tips. Peritoneum silvery with brown spots; intestine shorter than body; air-bladder very large. Lateral line complete, barely decurved anteriorly, running a little below middle of depth on caudal peduncle. Scales moderate, 5.5 or 6 from origin of dorsal to lateral line, 13 between dorsal fin and occiput, 40 (39 to 41) along lateral line to caudal base, 3 (3 to 4) between lateral line and ventral insertion, 4.5 between lateral line and anal origin, 15 around narrowest part of caudal peduncle. The individual scales are broadly semioval in outline, with basilateral angles narrowly rounded; the basal margin truncate, with a broad median convexity; the focus within the basal fourth of the length of the scale; the basal circuli close-set and parallel with the basal margin, while the lateral circuli are moderately spaced, about as in most American *Cyprinidæ*, and flare outwardly to meet the scale margin at an angle; the anterior field traversed only by rudimentary circuli, but with the radii rather strong and numerous, extending from very near the focus and from intermediate origins to points on the margin, between which the scale is produced in narrow scallops; no lateral or basal radii. Dorsal rays, 2, 7; anal, 2, 6; dorsal fin inserted well forward, its fourth ray lying over ventral insertion, its origin nearer by length of eye from tip of snout than caudal base; origin of anal but little nearer end of dorsal base than caudal base; length of the depressed dorsal contained 1.2 times in the dorso-occipital interval; pectoral reaching to within less than one diameter of eye from ventral, which fails to reach the anus by a somewhat greater distance; the depressed anal reaches about to middle of caudal base; second dorsal ray a very little stiffened basally, but still quite flexible; it remains thin and preserves the articulations, being essentially like the corresponding anal ray, and barely showing an approach toward the bony spine of *Hemibarbus*.

The most striking feature of the species is the coloration, correctly indicated on Plate IX, Fig. 3.

131. [192] **Pseudogobio esocinus** (Temminck and Schlegel).

Kamatsuka = River Dodger.

Lake Biwa, Kachi River at Nagoya (Jordan); Kumamoto (Wakiya); Lake Suwa (Jordan); Nagano (Nakano); Himeji (Abe); Okayama (Mikamo); Chikuma River (Ota); River at Yamada (Tsuchiga).

A gudgeon of remarkable appearance, looking like the American genus *Hypentelium*.

Genus SARCOCHEILICHTHYS Bleeker.

In *Sarcocheilichthys* the barbels are very variable. In *S. variegatus*, though constantly short and slender in the young, they become shorter and thicker with age, often becoming reduced to papillæ, or are even entirely lost. The lower lip is thick and fleshy on each side, but obsolete toward the hard and narrow symphyseal projection; the gape as viewed from below is strongly sigmoid on each side.

The anus is advanced in position, being almost as near the ventral insertion as the anal origin. The oviduct is extended as a long white tube, which is retractile within a large pocket, and which carries the rectum outward for some distance along its front border.

In *Pungtungia* and *Pseudorasbora* the lower lip is also practically restricted to the lateral lobes; in *Pungtungia* the mouth is also inferior, but the median extension of the mandible is broad and truncate, and the barbel is longer; in *Pseudorasbora* the mouth is dorso-terminal and transverse, and the barbel wholly lacking. In *Biwia* the lower lip is continuous, but everywhere thin, the mouth small and inferior, the gape a half-oval; in *Abbottina* the lower lip on each side is heavy and divided into a lateral lobe and an anterior almost barbel-like process; in *Pseudogobio* the greatly expanded lips, as well as the fleshy structure surrounded by the lower lips, are all strongly papillate.

132. [193] **Sarcocheilichthys variegatus** (Temminck and Schlegel).

Higai = Red Dace; *Sakura-bae* = Cherry-Dace.

Lake Biwa (Jordan and Kawamura); Kachi River at Nagoya (Jordan); Kumamoto (Wakiya); Himeji (Abe); Lake Suwa (Ota); Lake Mikata, Lake Kasumigaura (Hattori).

A common species in Lake Biwa.

133. [Extraterr.] **Sarcocheilichthys morii** Jordan and Hubbs, sp. nov.

Type, a female 100 mm. long to caudal fin, collected by Dr. Yōjirō Wakiya in the River Ping-yang, Korea, (C. M. Cat. Fishes, No. 7824).

Dorsal rays, 2, 7; anal, 2, 6; scale rows 4.5 or 5–39–5 (to anal origin) or 3.5 (to ventral insertion); pharyngeal teeth 5, 1–1, 5, weakly and bluntly hooked, with developed grinding surfaces; no barbels. Head, 4.2; depth of body, 3.8; depth of caudal peduncle two-thirds its length, 1.75 in head; eye 4.5; snout, 2.65; interorbital, 2.95. Mouth small, the upper jaw reaching to below nostril only; lower jaw pointed, included; lower lip thick and pendant on sides, interrupted in the middle. Fourth dorsal ray over insertion of ventral, and midway between tip of snout and base of caudal; top of dorsal straight; the first branched ray longest, 1.15 in head; caudal forked; pectoral rounded, its length 1.3 in head, or 1.3 in pectoral-ventral interspace; ventral fins reaching almost to anus, 1.45 in head; anal fin with straight margin, its longest ray, 1.6 in head; anus distant from anal fin, but nearer anal than ventral; rectum carried out for some distance along front of produced oviduct; lateral line straight, complete.

General color pale, deepening on back, and marked by irregularly disposed, vertically elongate, deep brown spots, and by dark scale-edgings. Dorsal with some red medially, with a subterminal blackish bar on the rays only, black streaks distally on first two interradial membranes, and medially in last two membranes; base of rays black, the first branched ray for over one-third its length, those following for a progressively lesser distance; caudal lobes, especially the lower one, darkened mesially. Prof. Mori in his recently published "List of the Fresh-water Fishes of Korea," simply records the names of this species. Two other species have been described from the Yangtse-Kiang and one from the Amur Basin.[55] The Korean form appears to be related to *Sarcocheilichthys maculatus* (Günther),[56] but differs in various counts and proportions.

We name this minnow for Professor Tamezo Mori, mammalogist of the Heijo High School, Seoul, Korea, who is making a study of Korean vertebrates. Professor Mori, at Stanford University, while these lines are being written, has a specimen of the same species (which we designate as a paratype), from the Han River, Korea.

Genus PUNGTUNGIA Herzenstein.

Pungtungia HERZENSTEIN, Bull. Ac. Imp. Sci. St. Pet., XIII, 1892, p. 231 (*P. herzi*).

Zezera JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 837, (*Z. hilgendorfi* Ishikawa).

We have been able to examine specimens of *Pungtungia herzi* (the typical species of the genus) through the courtesy of Prof. Tamezo Mori, who collected them in the Han River, Korea. This Korean species usually has the teeth 5–5, as in *P. herzensteini*, and in fact differs but slightly from that species. The snout is somewhat longer, a little longer than the postorbital.

The Japanese genus *Zezera* from Lake Biwa seems inseparable from *Pungtungia*.

134. [195] **Pungtungia hilgendorfi** (Ishikawa).

Kumamoto, Hamada (Wakiya); Himeji (Abe); Yamaguchi (Ishikawa).

Jordan and Fowler described this species on the basis of their own material, although Ishikawa had already named it in manuscript. The specimen described by Jordan and Fowler (Cat. No. 7722, Stanford Fish Collection) becomes the type of the species, and Funayado on Kyūsyū Island the type-locality.

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[55] Leo Berg, Mem. Acad. Imp. Sci. St. Petersb., (8), XXIV, 1909, 91.

[56] *Pseudogobio maculatus* Günther, Ann. Mag. Nat. Hist., (6), I, 1888, pl. 432.—Steindachner; Denksch. Akad. Wiss. Wien, LIX, 1892, p. 370, fig. 4 (figure of oviduct).

135. [197] **Pseudorasbora parva** (Temminck and Schlegel). *Moroko* = Minnow.

Kachi River, at Nagoya (Jordan); Kumamoto (Wakiya); Lake Mikata, Fukiu, Fukuoka, Lake Biwa at Otsu (Jordan and Kawamura).

Nuptial males have the pearl-organs restricted to a single series along the sides of the cheeks, and to a series on the lower side of the head, inside the curve of the mouth. Mr. George S. Myers has lately shown that the nominal species, *Fundulichthys virescens* Schlegel is based on a bad figure of *Pseudorasbora parva*.

ACAHARA Jordan and Hubbs, gen. nov.

Type: *Richardsonius semotilus* Jordan and Starks.

Mori in his "List of Fresh-water Fishes of Korea" makes incidental reference to the as yet unpublished generic name *Acahara*, Jordan and Hubbs, referring to it *Richardsonius semotilus* and *Richardsonius brandti*. As this was the first appearance of this generic name in print, *R. semotilus* may be designated as the type of the genus.

Of the Japanese minnows currently referred to *Leuciscus* two, having large scales, belong in *Gnathopogon* (*cærulescens* and *japonicus*); three, *hakonensis*, *phalacrocorax*, and *taczanowskii*, together with *Phoxinus septentrionalis*, comprise a group which we here name *Acahara;* while other species *jouyi* and *dorobæ*, together with *Phoxinus steindachneri* and *Pseudaspius atrilatus*, form another natural series, which we call *Moroco*. Both *Acahara* and *Moroco* are also represented by species on the Asiatic mainland.

Neither of these groups seem to be congeneric with *Cyprinus leuciscus* Linnæus, which through tautonymy is the type of the genus *Leuciscus* Cuvier (1817). That genus corresponds to *Dobula* Rafinesque (1820) to *Squalius* Bonaparte (1837) and to *Cephalus* Bonaparte (1845). At present *Acahara* cannot be sharply differentiated from *Telestes* (*Telestes multicellus*), another European group, nor from some of the American divisions of *Leuciscus*, such as *Siboma* and *Tigoma*. But while awaiting a critical study of all the leuciscine types, we think it safer and more natural to define and name the group *Acahara* than to refer it to any of the genera mentioned. The genus *Moroco* is still more readily separated.

The provisional genus *Acahara* comprises large dace having the following characters: body elongate, subterete; head bluntly subconic, with the mouth slightly overhung by the rostral fold; gape slightly oblique, arched; lower jaw included; lips normal, the lower with a broad frenum; gill-rakers short and slender, 9 to 12 in number on lower limb of outer arch; pharyngeal teeth biserial, with four or five hooked teeth in the outer row, and two teeth in the lesser series; dorsal fin inserted over ventral base a little behind middle of length of body; anal fin inserted far behind dorsal; dorsal with seven, anal with seven or eight branched rays; scales rather small, 60 to 93 along lateral line; each scale oval in outline, with the focus well basad of middle; lateral and apical radii strongly developed; circuli subcontinuous, present on all fields, nearly parallel to scale-margin, and moderately well spaced, as in American minnows in general; intestine short; peritoneum pale; color uniform, without specialized darkened scales. In breeding males the pearl-organs are thickly scattered over the top of the head and body; of these a few (about one to a scale on the back and a corresponding number on the top of the head) may be somewhat enlarged, and white in color; minute hooks are ranged in single file along the rays on both sides of the dorsal and anal fins, and on the inner side of the paired fins.

Three species of *Acahara* may be recognized in Japanese waters, being distinguished by the size of the scales. In most of the rivers and adjacent coasts the scales are about seventy-five in number, the extreme known range being from sixty-five to eighty-three, the average varying with the locality from about seventy to about eighty, without definite geographical correlation. The names *hakonensis* (by error *hakuensis*), *taczanowskii*, and *septentrionalis* belong with this seemingly inseparable complex. In the streams tributary to Tokyo Bay and Lake Kasumigaura there is a better defined race, with only 60 to 71 scales (average 66.2) in the row; this form, *phalacrocorax*, may be retained as a valid species. In Lake Jusan, near Aomori, there is an equally distinct form, which we call *jusanensis*, known by a single specimen having more than 90 scales along the lateral line.

The vernacular name, *Akahara* (Red-belly), currently applied to the species of this genus, refers to a narrow stripe of bright red running straight from the head to the tail in the adult male.

136. [201 and 202] **Acahara hakonensis** (Günther).

Ugui = Dace; *Aka-hara* = Red-belly.

Leuciscus hakuensis Günther, Challenger Reports, Shore-Fishes, 1880, p. 72, pl. 31, fig. B. (adjudged by the International Commission on Zoölogical Nomenclature to be a slip from *hakonensis*, Lake Hakone being misread "Hakoue" on the label).

Phoxinus septentrionalis Jordan and Seale, Proc. U. S. N. M. XXX, 1906, p. 143, fig. 1.

Tokyo market (Jordan); Hamada (Wakiya); Lake Kawaguchi (Wakiya and Ishikawa); Lake Yamanaka (Wakiya and Ishikawa); Nagano (Nakano); Himeji (Abe); Okayama (Mikamo); Akita, Hiki River, Kishu, (Kuroiwa); Lake Kisaki

(Ota); Aomori (Beppu); Toyama (Yoshizawa); Noo (Morioka), Awaya, Lake Togo, Tottori (Inomata); Kamishibi near Fukui, Lake Mikata, Fukui, Lake Suwa (Jordan); Lake Biwa (Jordan); Lake Hakone (Jordan).

A very narrow straight bright orange stripe along lower part of body in males; some orange on lower part of head.

The minnows of Japan referred by Jordan and Fowler[57] to *Leuciscus hakuensis*, *L. phalacrocorax*, and *L. taczanowskii* appear to represent a group of local races, between none of which can any trenchant differences be discovered. Their *L. taczanowskii* is composed of two forms, one with about 80 the other with about 90 scales in the lateral line; the former represents *L. taczanowskii* proper, while the latter lies without the known limits of variation of the other Japanese forms, and is here regarded as a new species, *L. jusanensis*. Our material from tributaries of the Japanese Sea shows fewer scales on the average, not more, as currently indicated, than is characteristic of true *hakonensis* (of which we have topotypic material). We are in fact unable to distinguish nomenclaturally between the majority of the local races. One race, however, that named *L. phalacrocorax* by Jordan and Fowler, seems well enough differentiated to warrant its retention as a valid species.

SCALE-VARIATION IN ACAHARA HAKONENSIS.

LOCALITIES	SCALES ALONG LATERAL LINE TO CAUDAL BASE.																			AVERAGES
	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	
Lake Kawaguchi	1	..	..	..	..	2	2	..	..	..	1	..	..	..	..	..	..	..	..	70.3
Aomori, Morioka, and Otaru	..	..	..	1	2	..	4	2	1	2	1	1	..	..	1	..	..	..	..	72.3
Lake Yamanaka	..	..	..	..	..	..	1	2	1	..	2	1	..	..	..	..	..	..	..	73.4
Drainage of Sea of Japan	..	..	..	1	..	..	..	2	2	1	2	3	2	..	1	1	..	..	1	74.7
Ebisu, Sado Island	..	..	..	..	..	..	..	1	..	..	2	1	..	..	..	..	..	..	..	74.5
Lake Biwa	..	..	..	..	..	..	2	..	..	..	4	4	1	..	..	..	..	..	..	74.8
Nagano	..	..	..	..	..	..	..	1	1	..	2	1	..	..	1	1	..	..	..	75.7
Drainage of Inland Sea	..	..	..	..	..	..	..	..	1	1	..	..	2	..	1	..	..	..	..	76.0
Lake Hakone	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	1	..	..	78.0
Tokyo Market	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	2	..	..	..	79.0
Totals	1	..	..	2	2	2	9	8	6	4	14	12	7	..	4	4	1	..	1	74.5

Phoxinus septentrionalis Jordan and Seale, of which we have paratypes at hand, is based on young specimens of *Acahara hakonensis*. The supposed incompleteness of the lateral line is largely due to the accidental loss of scales.

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[57] Proc. U. S. N. M. ,XXVI, 1903, pp. 844–848.

137. [205] **Acahara phalacrocorax** (Jordan and Fowler). *Aka-hara* = Red-belly.

Tama River, just below the original type-locality (Jordan); Lake Kasumigaura (Hattori); Fukui. Males with an orange lateral streak, lower fins bright red.

This species is merely the local form of the wide-spread *Leuciscus hakonensis*, representing that form in the waters tributary to Tokyo Bay and Lake Kasumigaura just to the northward. It is distinguished by the larger size of its scales, which number 13 to 16, most usually 14, from the origin of the dorsal fin to the lateral line, and 60 to 71 (average, 66.2) along the lateral line to the caudal base. In *Leuciscus hakonensis* there are 13 to 18, most frequently 15 scales from the dorsal fin to the lateral line; and 65 to 83 along the lateral line to the caudal fin, the average ranging in different races from about 70 to about 80, and being for the entire series as counted by us, 74.5. Further work, however, will probably show still further intergradation between the two forms, and it may become impossible to recognize *L. phalacrocorax* as distinct.

138. [206] **Acahara jusanensis** Jordan and Hubbs, sp. nov.

Leuciscus taczanowskii Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 848 (description, and Lake Jusan record only); (not of Steindachner).

The type is an adult specimen from Lake Jusan, near Aomori, Province of Mutsu, presented to Dr. Jordan by Director Sotaro Saito of the Aomori Museum in 1900; Cat. No. 7352, Stanford University collection (Car. Mus. Cat. Fishes, No. 7828).

This species is sufficiently well described by Jordan and Fowler. The scales in the lateral line, 93 on one side, 90 on the other, are smaller than in related species.[58] According to Dr. Berg *Leuciscus taczanowskii* is identical with *Leuciscus brandti* (Dybowsky). This species is recorded by Jordan and Metz from Chinnampo and Gensan. A very distinct species of *Acahara* (*A. semotilus* Jordan and Starks) has been described from Fusan in Korea. In *A. brandti* from Lake Chanka, Siberia, the scales are 83, the back blackish.

Genus Moroco Jordan and Hubbs, gen. nov.

Type: *Pseudaspius bergi* Jordan and Metz.

Mori in his "List of Fresh-water Fishes of Korea" has listed *Moroco bergi* Jordan and Hubbs without explanation, having evidently taken the name from a labelled specimen in the Stanford University Collection. This publication induces us to make *P. bergi* the genotype of *Moroco*, as it is the first species to be published under the new generic name, which we are here proposing.

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[58] See Berg, Ichth. Amurensis, 1909, pp. 105–108.

Our reasons for separating this group from *Leuciscus* appear in the discussions under the head of the genus *Acahara* and in the following description.

Body approaching the form of a Top-minnow (*Gambusia*), the anterodorsal and posteroventral outlines being subhorizontal and parallel; snout pointed, somewhat overhanging the upper lip; lower jaw included, with its lip rather thick, with a broad frenum; gill-rakers more or less rudimentary, only 3 to 6 on lower limb; pharyngeal teeth biserial, with four or five teeth in the outer row, and two in the lesser row; dorsal fin posteriorly located, its origin being behind the end of ventral base; origin of anal under its last ray; dorsal and anal each with seven branched rays; scales small or minute; individual scales oval in outline, with the focus well basad of middle; the radii strongly developed on all fields of scale; the circuli continuous, well-spaced and parallel with margin of scale; intestine short; peritoneum dark. Body marked with specialized darkened scales, as in certain American genera (*Rhinichthys*, etc.). Nuptial males with the upper parts of the head and body covered with minute pearl-organs.

Moroko is a vernacular name for small dace of this type.

In addition to the type-species we refer three other species to *Moroco*. They may be distinguished by means of the following key.

c. Caudal peduncle excessively deep in the adult, its least depth nearly two-thirds length of head. Scales in lateral line to caudal base fewer than 70. Tsushima........................*jouyi.*

cc. Caudal peduncle moderately deep in the adult, its least depth about half length of head. Dark scales more conspicuous than the lateral stripe.

  d. Scales in the lateral line 70 to 80. Eye in adult only half length of snout. Southern Japan. *steindachneri.*

  dd. Scales in the lateral line about 100. Korea..*bergi.*[59]

ccc. Caudal peduncle slender in the adult, its least depth about one-third length of head. Dark lateral stripe more conspicuous than the darkened scales. Scales in lateral line about 80. Lake Yamanaka..*yamamotis.*

139. [200] **Moroco steindachneri** (Sauvage).

Abura-hai = Fat minnow; *Dorobaë* = Mud-minnow.

Phoxinus steindachneri SAUVAGE, Bull. Soc. Philom., Paris, 1883, p. 5.—JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 850 (after Sauvage).

Hemitremia steindachneri JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 71 (after Sauvage).

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[59] *Pseudaspius bergi* Jordan and Metz, Mem. Car. Mus., VI, 1913, p. 22, pl. III, fig. 2 (scale-count apparently too high). *Pseudaspius modestus* Jordan and Metz, *l. c.*, p. 23, pl. III, fig. 3 (scale-count too low). We have examined the paratypes of these nominal species, and find the scale-counts in essential agreement.

Leuciscus jouyi Jordan and Fowler, *l. c.*, p. 849 (Kaminutani River, record only);—Tanaka, Annot. Zoöl. Jap., VII, 1909, p. 134. Not *Leuciscus jouyi* Jordan and Snyder.

Leuciscus dorobæ Ishikawa, Proc. Dept. Nat. Hist., Tokyo Imp. Univ., I, 1904, p. 6, pl. 3, fig. 2.

Pseudaspius atrilatus Jordan and Thompson, Mem. Car. Mus., VI, 1914, 231, pl. XXVI, fig. 3 (paratypes seen).

Kumamoto, Hamada (Wakiya); Toyama (Yoshizawa); Kinano River, Kishu (Kuroiwa); Kamishibi, Fukui, Nagano (Nakano); Yamanashi (Imperial Museum 1900).

It has not heretofore been suspected that the three names listed in the synonymy really refer to the same fish, but we are quite sure that this is the case. The species is extremely close to *Moroco jouyi,* which appears to be a local form confined to the island of Tsushima, and differing from both the Japanese *M. steindachneri* and the Korean species, *M. bergi.* These forms are contrasted in the key given above.

Nuptial males have the upper parts of the head and body covered with minute pearl-organs.

140. [200A] **Moroco yamamotis** Jordan and Hubbs, sp. nov.

Type 110 mm. long to caudal base, collected by Masashi Ishikawa in Lake Yamanaka on the East side of Fuji-San in Koshu, Car. Mus. Cat. Fishes, No. 7829. Two paratypes, 96 and 63 mm. long, were obtained with the type.

This species bears a fairly close resemblance to *Leuciscus hakonensis* (of which we have specimens taken in the same lake), but it differs trenchantly in having the gill-rakers reduced to three to five fleshy projections, in place of the nine to twelve well developed slender rakers of *A. hakonensis;* in having the dorsal fin inserted more posteriorly, nearer base of caudal than the middle of eye (rather than the reverse); in the thicker, heavier lips; in the reduction in the size of the scales on the back, there being about 50 instead of about 35 rows before the dorsal fin; in coloration, etc. In most of these respects it agrees with *Moroco jouyi* and *M. steindachneri,* of which it may well be the local representative. In general appearance it is quite unlike *M. jouyi,* the body being slenderer, the caudal peduncle attenuate, rather than greatly deepened, in the adult about one-third, instead of two-thirds, as long as the head. In general the coloration is much paler, the darkened scales being only indistinctly developed, although the lateral band is more conspicuous; moreover the scales are smaller than in *M. jouyi*. In the form of the caudal peduncle it is less sharply separated from *M. steindachneri*, but the same color differences hold; the eye is larger than in *M. steindachneri*. These differences are given in tabular form in our key.

Body formed as in *Moroco jouyi*, the anterodorsal outline being horizontally flattened, the tail bent downward, but much slenderer and especially attenuate posteriorly. Greatest depth of body, 4.65 (to 4.8) in standard length; least depth of caudal peduncle from anal base to center of caudal base, 3.1 (2.9 to 3.2) in length of head. Top of head flattened, not very convex either transversely or longitudinally only gently decurved anteriorly to the edge of the rostral fold, which is well developed, and partially covers and overhangs the upper lip, and lies on level of lower border of pupil; lips full laterally, the lower with a broad median frenum; the mouth slightly curved and somewhat oblique; gape largely lateral; upper jaw as long as snout, extending to below front of eye. Head with membrane, 3.5 in standard length. Eye 1.6 (to 1.0 in young) in snout, 4.8 (to 3.8) in head; snout, 3.1 (to 3.6); fleshy interorbital, 3.6 (to 3.65). Gill-rakers 3 to 5 below angle on outer arch, all soft and very weak. Pharyngeal teeth 4, 2–2, 5, hooked, but without developed grinding surfaces. Peritoneum dark. Intestine short; diet carnivorous. Scales smaller than in other species of *Moroco* except *M. bergi*, 21 or 22 from origin of dorsal to lateral line, 78 (77 to 83) in lateral line; 53 from origin of dorsal to occiput; 8 to 11 from lateral line to ventral; as seen under microscope oval, with focus well basad of middle; circuli rather coarse, well separated, running parallel with margins of scales, radii strongly developed on all fields, including the basal. Lateral line very weakly decurved anteriorly; running a little below middle of depth posteriorly. The dorsal fin, when depressed, not quite half as long (except in young) as distance from its origin to occiput; pectoral contained 1.7 (to 1.5) times in interval between bases of paired fins; ventral fin reaching anus; anal not reaching much more than half-way to caudal.

Color pale, becoming darker above, particularly on snout; specialized darkened scales present, but not conspicuous; a dark lateral band follows the axial septum of the body muscles, indistinct anteriorly, where it curves upward well above the lateral line, but blackish posteriorly, where it follows the lateral line; all fins with some pigment, but the anal and ventrals quite pale.

The species is named for Dr. Senzi Yamamoto of the Imperial University of Kyoto.

Genus ZACCO Jordan and Fowler.

The species of this genus have been considerably confused by various authors. We offer a brief synopsis of them, as far as they are known.

a. Scales relatively large, 8 (usually) or 9 from origin of dorsal to lateral line, 39 to 45 along lateral line to caudal base. Mouth of moderate size, the upper jaw much less than half length of head; body marked with vertical dark bars; anal fin of breeding male extended far beyond caudal base.
  b. Pectoral fins of moderate length, in females and immature males not nearly reaching vertical from ventral fin, in breeding males barely reaching that point; nuptial tubercles on cheek fused at base. Japan and Korea .... *platypus.*
  bb. Pectoral fins elongate, in females and immature males about reaching vertical from ventral fin, in breeding males much longer; nuptial tubercles on cheek separate. Formosa .... *evolans.*
aa. Scales smaller, 9 (rarely) to 15 from origin of dorsal fin to lateral line, 46 to 62 along lateral line to caudal base.
  c. Mouth of moderate size, the upper jaw scarcely more than one-third length of head; rostral fold large, nearly concealing the premaxillaries.
    d. Nuptial tubercles of head smaller and separate; side with a dark longitudinal streak, but without cross-bars. Japan and Korea .... *temmincki.*
    dd. Nuptial tubercles on side of snout and on cheek hugely developed, and arising in each case from a broad horny common base; male at least with vertical cross-bars. China. *acanthogenys.*[60]
  cc. Mouth very large, the upper jaw almost half as long as the head; rostral fold not expanded, and not concealing the premaxillaries; nuptial tubercles of head separate; vertical cross-bars often developed. Formosa .... *pachycephalus.*

141. [211] **Zacco platypus** (Temminck and Schlegel). *Haya* = Minnow.

Leuciscus platypus (TEMMINCK and SCHLEGEL) RICHARDSON, Rept. Brit. Assoc. Adv. Sci., for 1845 (1846), p. 300 (on proof-sheets of Schlegel's later account. —TEMMINCK and SCHLEGEL, Fauna Japonica, Pisces, 1846, p. 210, pl. 101, fig. 3. (Nagasaki).

Opsariichthys platypus GÜNTHER, Cat. Fishes Brit. Mus., VII, 1868, p. 296 (Formosa records excepted).—SAUVAGE, Bull. Soc. Philom., 1883, p. 5.

Barilius platypus BLEEKER, Verh. Akad. Amsterdam, XVIII, 1879, p. 23.—JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1901, p. 344; Annot. Zoöl. Jap., III, 1901, p. 47.—REGAN, Proc. Zoöl. Soc. London, 1908, p. 59 (Korean record).

Zacco platypus JORDAN and FOWLER, Proc. U. S. N. M., XXVI, 1903, p. 851.—SMITH and POPE, *ibid.*, XXXI, 1906, p. 462.—TANAKA, Zoöl. Mag., No. 237, 1908, p. 235; Annot. Zoöl. Jap., VII, 1908, p. 7, *ibid.*, VII, 1909, p. 133.—COCKERELL, Zoöl. Anz., XXXVIII, 1911, p. 85.—TANAKA, Fig. Desc. Fishes Jap., IV, 1911, pl. 200, figs. 72–74; *ibid.*, V, 1912, p. 83.—SNYDER, Proc. U. S. N. M., XLII, 1912, p. 404.—JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 75.—JORDAN and THOMPSON, Mem. Car. Mus., VI, 1914, p. 232.—OSHIMA, Ann. Car. Mus., X, 1919, p. 237 (Japanese specimens only).

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[60] *Opsariichthys acanthogenys* Boulenger, Proc. Zoöl. Soc. London, 1901, p. 269, pl. 24, fig. 1. The University of Michigan has material of this species from Foo-chow, China.

Leuciscus minor (Temminck and Schlegel) Richardson, Rept. Brit. Assoc. Ad. Sci., 1845 (1846), p. 300.—Temminck and Schlegel, Fauna Japonica, Pisces, 1846, p. 210, pl. 101, fig. 3.

Barilius minor Bleeker, Verh. Akad. Amsterdam, (2) III, 1867, p. 248; Verh. Akad. Amsterdam, XVIII, 1879, p. 23.

Leuciscus macropus Temminck and Schlegel, Fauna Japonica, Pisces, 1846, p. 209, pl. 101, fig. 2.

Barilius macropus Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 23.

Lake Biwa at Otsu (Jordan and Kawamura); Kumamoto (Wakiya); Himeji (Abe); Okayama (Mikamo); Lake Suwa (Jordan); Fukuoka (Hamada); Lake Mikata, Fukui, Kachi River at Nagoya (Jordan); Lake Kasumigaura (Hattori). Generally common southwards.

Barilius acutipinnis Bleeker, from the Yang-tse-Kiang of China, is perhaps identical with *Zacco platypus*. The relation of *Zacco* to *Barilius* is in need of definition.

Zacco platypus has erroneously been identified with a Formosan species, *Z. evolans*, by Oshima, and with a Chinese species, *Opsariichthys bidens*, by Boulenger.

The pharyngeal teeth may be 4 or 5 in the outer row. The scales do not vary widely in number, there being usually 8, occasionally 9 from the origin of the dorsal to the lateral line, and from 39 to 45, usually 41 to 43, along the lateral line to the caudal base. In fully developed males, the anal fin is extended (by the growth of the rays, not by adipose extentions, as has been suggested) far beyond the caudal base, (much farther than in *Z. temmincki*); the nuptial tubercles on the cheeks are united basally to form a plate approaching that of *Z. acanthogenys* (a condition not noted in *Z. temmincki*), but the pearl-organs on the lower side of the caudal peduncle are very small, several to a scale (in *Z. temmincki* these organs are enlarged and only one is developed on each scale).

142. [Extraterr.] **Zacco evolans** Jordan and Evermann.

Opsariichthys platypus Günther, Cat. Fishes Brit. Mus., VII, 1868, p. 296 (Formosan record only).

Zacco platypus Oshima, Ann. Car. Mus., X, 1919, p. 235 (most of synonymy and note on "cotype" of *Z. evolans* excepted); Proc. Acad. Nat. Sci. Phila., 1920, p. 130 (not of Richardson).

Zacco evolans Jordan and Evermann, Proc. U. S. N. M., XXV, 1902, p. 322, fig. 5 (type, but not "cotype").—Jordan and Richardson, Mem. Car. Mus., IV, 1909, p. 170, fig. 6.

Zacco temmincki Oshima, Ann. Car. Mus., X, 1919, p. 240 (specimens from Daito River only).

We have examined the type of this Formosan species (the paratype is referable rather to *Zacco pachycephalus*), part of the material called *Z. platypus* by Oshima, and two specimens from Daito River, wrongly referred by Oshima to *Zacco temmincki*.

143. [212] **Zacco temmincki** (Temminck and Schlegel). *Kawamutsu* = River-mutsu.

Leuciscus temmincki (Temminck and Schlegel) Richardson, Rept. Brit. Assoc. Adv. Sci. for 1845 (1846), p. 300 (scales erroneously counted, but identification fixed by note on color; account prior to that by Schlegel, who is quoted as unpublished).—Temminck and Schlegel, Fauna Japonica, Pisces, 1846, p. 210, pl. 101, fig. 4.

Opsariichthys temminckii Günther, Cat. Fishes Brit. Mus., VII, 1868, p. 295.—Matsubara, Jap. Intern. Fisch.-Ausst., Berlin, 1880, p. 17.—Namiye, Class. Cat. Spec. Vert., 1881, p. 107.—Sauvage, Bull. Soc. Philom., 1883, p. 5.—Ishikawa, Zoöl. Mag., VII, 1895, p. 121.—Ishikawa and Matsumura, Prel. Cat., 1897, p. 11.

Barilius temmincki Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 23.—Jordan and Snyder, Annot. Zoöl. Jap., III, 1901, p. 47.

Zacco temmincki Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 852.—Tanaka, Zoöl. Mag., No. 237, 1908, p. 235.—Snyder, Proc. U. S. N. M., XLII, 1912, p. 404.—(?) Jordan and Metz, Mem. Car. Mus., VI, 1913, p. 21 (Korean record).—Jordan and Thompson, *ibid.*, VI, 1914, p. 232.—Oshima, Ann. Car. Mus., X, 1919, p. 238 (most of synonymy only).—Tanaka, Annot. Zoöl. Jap.,VII, 1909, p. 134.—Jordan, Tanaka, and Snyder, Jour. Coll. Sci. Tokyo, XXXIII, 1913, p. 75.—Tanaka, Fig. Desc. Fishes Jap., XVII, 1914, pl. 81, fig. 275; *ibid.*, XVIII, 1914, p. 296.

Leuciscus sieboldi Temminck and Schlegel, Fauna Japonica, Pisces, 1846, p. 211, pl. 101, fig. 5.

Opsariichthys sieboldi Günther, Cat. Fishes Brit. Mus., VII, 1868, p. 295.—Sauvage, Bull. Soc. Philom., 1883, p. 5.

Barilius sieboldi Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 23.—Jordan and Snyder, Annot. Zoöl. Jap., III, 1901, p. 47.

Zacco sieboldi Jordan and Fowler, Proc. U. S. N. M., XXVI, 1903, p. 854.—Tanaka, Annot. Zoöl. Jap., VII, 1908, p. 6; Zoöl. Mag., No. 237, 1908, p. 235.—Jordan and Thompson, Mem. Car. Mus., VI, 1914, p. 232.

Zacco mitsukurii ISHIKAWA, Proc. Dept. Nat. Hist., Tokyo Univ., I, 1904, p. 4, pl. 1, fig. 1.

Zacco mitsukurii, var. a, ISHIKAWA, *ibid.*, p. 5, pl. 2, fig. 2.

Hamada, Kumamoto, Ozu, Island of Shikoku, Lake Biwa (Wakiya); Mikawa Bay (Ishikawa); Himeji (Abe); Okayama (Mikamo); Fukuoka (Hamada); Yamaguchi.

The number of scale-rows in this species varies widely, but we are unable to find evidence indicating the existence of two species, *Z. temmincki* and *Z. sieboldi*, differing in the number of scales, and ranging side by side through southwestern Japan. The variations seem rather to be of a purely local character. Our counts may be tabulated as follows:

ZACCO TEMMINCKI.

NUMBER OF TRANSVERSE ROWS OF SCALES

LOCALITIES	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	AVERAGES
Shikoku Island, Drainage of Inland Sea	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	46
Mikawa Bay (East of Inland Sea)	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	48
Hondo Drainage of Inland Sea	1	..	2	7	1	2	3	..	3	1	1	3	..	..	..	52
Hamada, Drainage of Sea of Japan	..	1	..	..	..	2	4	2	1	..	..	..	..	..	..	52
Kyūsyū (South of Inland Sea)	..	..	..	..	1	..	1	..	..	2	..	1	..	..	..	54
Lake Biwa (*mitsukurii*)	..	..	..	..	..	..	..	..	1	2	4	3	6	3	1	57

SCALES FROM DORSAL FIN TO LATERAL LINE

LOCALITIES	9	10	11	12	13	14	15	AVERAGES
Shikoku Island, Drainage of Inland Sea	..	..	1	..	..	..	..	11.0
Mikawa Bay (East of Inland Sea)	..	1	..	..	..	..	..	11.0
Hondo, (Drainage of Inland Sea)	1	12	4	2	3	3	..	11.1
Hamada (Drainage of Sea of Japan)	..	..	8	4	..	..	..	11.3
Kyūsyū, (South of Inland Sea)	..	..	..	1	1	3	..	13.4
Lake Biwa (*mitsukurii*)	..	..	..	..	5	12	3	13.9

The variations in the number of scales seem to show no very definite geographical correlation. The most noteworthy feature is the high average number in the specimens from Lake Biwa.

144. [Extraterr.] **Zacco pachycephalus** (Günther).

Opsariichthys pachycephalus GÜNTHER, Cat. Fishes Brit. Mus., VII, 1868, p. 296 (Formosa).

Zacco pachycephalus Jordan and Evermann, Proc. U. S. N. M., XXV, 1902, p. 322.—Jordan and Richardson, Mem. Car. Mus., IV, 1909, p. 170.—Cockerell, Zoöl. Anz., XXXVIII, 1911, p. 87.—Oshima, Ann. Car. Mus., XII, 1919, p. 240; Proc. Acad. Nat. Sci., 1920, p. 130.

Zacco platycephalus Fowler and Bean, Proc. U. S. N. M., LXIV, 1922, Art. 2, p. 7 (*lapsus* for *pachycephalus*).

Zacco evolans Jordan and Evermann, Proc. U. S. N. M., XXV, 1902, p. 322 ("cotype," not type).

Zacco platypus Oshima, Ann. Car. Mus., XII, 1919, p. 236 (note on "cotype" of *Z. evolans* only).

Zacco temmincki Oshima, *l. c.*, 1919, p. 238 (most of synonymy and specimens from Daito River excepted).—Fowler and Bean, Proc. U. S. N. M., LXIV, 1922, Art. 2, p. 6.

Zacco temminckii Oshima, Proc. Acad. Nat. Sci. Phila., 1920, p. 130. (Not *Leuciscus temmincki* Richardson).

Oshima and Fowler and Bean have both referred the finer-scaled Formosan species of *Zacco* to two species, *pachycephalus* and *temmincki*. But *temmincki* is a trenchantly different form, as the key we have prepared indicates. We have examined most of the material discussed by Oshima, but fail to find more than the one species represented. One of Oshima's lots, that from the Daito River, should have been referred to *Zacco evolans*.

The "cotype" of *Zacco evolans* is a male specimen of *Z. pachycephalus*.

145. [213] **Opsariichthys uncirostris** (Temminck and Schlegel). *Hasu.*

Lake Biwa, at Otsu (Jordan and Kawamura); Hachi, Fukui. It is abundant in Lake Biwa, reaching a length of a foot or more, and is much valued as food, its flesh being rich and delicate.

Nuptial males have coarse, broadly conic pearl-organs thickly set on the mandibles, the suborbital region, and the preopercle, occurring also at the tip of the lower jaw, and even on the lower and upper lips laterally, also between the nostrils, and on the cheeks, and interopercle. Other pearl-organs are scattered over the sides of the tail, usually several on a scale; they are strongest near the anal fin, becoming smaller dorsally and obsolete toward the back and toward the caudal fin; on the lower surface of the caudal, as also along the anal rays, they are in contrast much strengthened, and only one is located on each scale.

146. [Extraterr.] **Opsariichthys bidens** Günther.

Opsariichthys bidens Günther, Ann. Mag. Nat. Hist., (4) XII., 1873, p. 249.

Two specimens of this species were collected by Dr. Wakiya in the Ping-yang River, Korea. The *Opsariichthys* of the Asiatic mainland (China, Korea, and the Amur drainage) differs from the Japanese species in having somewhat larger scales: 44 to 48 along the lateral line, rather than 47 to 53; 9 from the dorsal fin to the lateral line, not 10 to 12; 3.5 rather than 4.5 or 5 from the lateral line to the anal origin. In our two specimens the scales are 9–45 or 46–3.5. Berg, who gives a good synonymy in his *Ichthyologia Amurensis* (1909), fails to separate these two species. To Berg's synonymy for *bidens* should be added: *Opsariichthys platypus* Boulenger, Proc. Zoöl. Soc. London, 1901, Part I, p. 24, pl. 24, fig. 2 (not of Richardson).

147. [176] **Ishikauia steenackeri** (Sauvage). *Wadaka*; *Uma-uwo* = Horse-fish.

Lake Biwa, at Otsu (Jordan and Kawamura). It is abundant in the lake, reaching a length of nearly two feet and is a food-fish of importance. The flesh is, however, far inferior to that of the excellent *Hasu*, with which it is associated.

Genus Hemigrammocypris Fowler.

(*Brevigobio* Tanaka.)

"No barbels about mouth; pharyngeal teeth 3-rowed, 4, 4, 2–2, 4, 4; dorsal fin inserted nearer to base of caudal than to tip of snout; a sharp ventral keel between anus and origin of ventral; lateral line decurved, incomplete, running along lower part of body, ending near last ray of anal" (Tanaka).

This genus in many ways is similar to *Rasbora*, a genus comprising many species from southern Asia and the East Indies, but it differs from that genus in having the abdomen sharply keeled, and in the normal structure of the lower jaw.

148. [176A] **Hemigrammocypris rasborella** Fowler.

Hemigrammocypris rasborella Fowler, Proc. Acad. Nat. Sci. Phila., LXII, 1910, 483, Lake Biwa.

Brevigobio kawabatæ Tanaka, Zoöl. Mag., XXVIII, 1916, p. 102 (Lake Biwa); Fig. Desc. Fishes Japan, XXIV, 1916, p. 420, pl. 115, figs. 339, 340 (Lake Biwa; pond near Tsu in Ise).

Kachi River at Nagoya (Jordan); Lake Biwa at Otsu (Jordan and Kawamura); Lake Biwa (Jordan).

Our specimens from the Kachi River are pale in color (like other fishes from the same place), almost lacking the longitudinal band. In this species the fine black streak which follows the axial septum is characteristically interrupted to form a series of dashes.

149. [214] **Cyprinus carpio** Linnæus. *Koi.*

Lake Kawaguchi, Mikawa Bay (Ishikawa); Ozu, Shikoku Id. (Wakiya); Nagano (Nakano); Himeji (Abe); Lakes Hakone and Suwa (Jordan); Lake Kasumigaura (Hattori).

The specimen from Lake Hakone is strikingly blotched with orange and black, as are many *Koi* domesticated in ponds.

150. [215] **Carassius auratus** (Linnæus). *Funa*; *Hiwara* = Red-belly.

Very abundant as a native fish, the *Funa* is domesticated everywhere and greatly modified in ponds, where it receives various names.

Lake Kawaguchi; Lake Yamanaka; Mikawa Bay; Kachi River; Kumamoto; Nagano; Himeji; Okayama; Akita, Sakurai; Yamaguchi; Toyama; Lake Hakone; Lake Suwa; Fukuoka; Noo, Morioka; Lake Kozan; Lake Togo (Inomata); Lake Kasumigaura (Hattori). We also have material from Soo-chow, China (Gee).

Most of the specimens are of the ordinary "wild type" of Gold-fish, only a few of these obtained showing the increased depth, elongated or fantastic fins, or orange color characteristic of many of the "domestic races."

The dorsal rays are fewer than indicated in most descriptions, being II, 12 to II, 16 in the specimens counted.

Family FLUTIDÆ.

Genus FLUTA Bloch and Schneider.

The name *Fluta* Bloch and Schneider (1801) is prior to *Monopterus* (Lacépède), which until 1806 appeared only as "les Monoptères." *Monopteros* Volta (1796) is a genus of fossil fishes (= *Platinx* Agassiz) and is prior to *Monopterus* Lacépède.

151. [216] **Fluta alba** (Zuieuw). *Taunagi* = Rice-field Eel.

Ponds near Kyoto (Kawamura); Formosa (Kawamura).

Family ANGUILLIDÆ.

152. [217] **Anguilla japonica** Temminck and Schlegel.
Unagi = Eel; *Ounagi* = Great Eel.

Mikawa Bay (Ishikawa); Himeji (Abe); Lake Suwa (Ota); Lakes Suwa and Hakone (Jordan); Fukuoka (Hamada); Lake Togo (Inomata); Lakes Mikata and Kasumigaura (Hattori). We also have a specimen from Soo-chow, China.

Everywhere abundant and highly valued as food. One of the specimens from Lake Kasumigaura belongs to the black-speckled type, which Jordan and Snyder and Ishikawa have regarded as a variant of the common species of Japanese eel.

Family SYNAPHOBRANCHIDÆ.

153. [220] **Synaphobranchus affinis** Günther. *Hora-anago* = Cave-eel.

Synaphobranchus taketæ Tanaka, Zoöl. Mag., XXVIII, 1917, p. 257 (text in Japanese).

Kushiro (Tanaka); Shizuoka (Jordan); Misaki (Aoki).

The position of the dorsal origin varies considerably, in our material being over, or rarely (as in the type of *S. taketæ*) a little before the anus, or as much as one-fourth length of head behind vertical from anus.

154. [222] **Synaphobranchus jenkinsi** Jordan and Snyder.

One of the eels taken by Aoki at Misaki agrees with the description of the type of this species in all respects, except that the eye is contained 2.5 times in the snout, the pectoral fin two times in the head.

Family CONGRIDÆ.

In previous descriptions of the Congers of Japan little or no attention has been paid to the dentition or the structure of the snout. A more careful examination of the several species has brought out characters apparently of generic significance, as the following key will show.

Key to the Genera of Congers of Japan and Formosa.

a. Premaxillary teeth entirely within the closed mouth (rarely slightly exposed in *Anago*); teeth biserial on jaws, those of the inner series very much the smaller. Tail blunt. Snout not notably produced beyond the mouth. Anterior nostrils low. Teeth all small, scarcely canine-like.

  b. Teeth of jaws conic, not in contact basally, and not forming a common cutting edge. Mouth small, the gape reaching only to below middle of eye. Tip of snout smooth. Dorsal fin beginning over, or very slightly behind, pectoral base . . . . *Anago.*

  bb. Teeth of jaws incisor-like, compressed, and in contact basally, forming a common cutting edge (the tips more or less separate in *Congriscus*). Mouth larger, the gape subtending all or most of eye. Tip of snout more or less distinctly tricarinate. Dorsal fin beginning well behind pectoral base.

    c. Teeth of jaws less truncate, with the tips largely free, not forming a very well defined cutting edge. Dorsal fin beginning a little in advance of middle of pectoral . . . . *Congriscus.*

    cc. Teeth of jaws evenly and abruptly truncate, the tips forming a well defined common cutting edge. Dorsal fin beginning over or behind middle of pectoral.

      d. Pores not surrounded by pigmented free areas, confined on body to lateral line and sparsely developed on head . . . . *Conger.*

dd. Pores surrounded by conspicuous pigmented free areas, forming a series below the dorsal fin, as well as along the lateral line, and densely developed on top of head anteriorly. . *Astroconger.*

aa. Premaxillary teeth largely or entirely in front of the mouth on the lower surface of the projecting snout. Teeth in jaws in a band or in two series of similar size. Tail more attenuate.

e. Anterior nostrils on lower surface of snout, beside premaxillary band of teeth, just within anterior end of upper lip, far below the anterior rostral pits. Upper lip separated from maxillary teeth by a wide flat ridge. Teeth all small, none canine-like, in a patch on the vomer; premaxillary teeth not entirely in advance of mouth, the posterior edge being covered when the mouth is closed. Gape short, extending only to below middle of eye. Gill-openings directed downward and backward.

f. Snout short, barely projecting beyond premaxillary teeth (and without pocket or keel on midline). Teeth fewer and larger, those on jaws mostly in rows, those on vomer bluntly conic, forming an elongate-triangular band (which separates the maxillary rows). *Alloconger.*

ff. Snout long, its fleshy tip projecting sharply beyond the premaxillary teeth. Teeth fine and close-set, those of jaws forming narrow bands, those on the vomer largely molar-like, forming a broad patch.

g. Premaxillary patch of teeth much smaller than the vomerine patch, and separated from it by the widely confluent anterior ends of the maxillary bands. Anteroventral line of snout occupied by a deep pocket. No enlarged pores between the nostrils. Posterior nostril a horizontal slit, with entire rim............................ *Rhynchocymba.*

gg. Premaxillary patch of teeth larger than the vomerine patch, and in full contact with it, the anterior ends of the maxillary bands thus being widely separated. Anteroventral line of snout occupied by a fleshy keel ending posteriorly in a small free process. A pair of enlarged pores between the nostrils. Posterior nostril widely open, with fimbriate border.. *Rhynchoconger.*

ee. Anterior nostrils on lateral face of snout, well above premaxillary teeth, far in advance of, and above, upper lip just behind the anterior rostral pits. Upper lip separated from maxillary teeth by a ridge, which is not flattened. Teeth largely canines, none molar-like; those on vomer not forming a patch; the premaxillary band entirely in advance of mouth, its posterior edge composed of large canines shutting outside the lower jaw. Gape relatively wide, extending almost to below hinder border of eye. Gill-openings directed downward and forward. A pair of enlarged pores just before premaxillary teeth. Posterior nostrils more or less slit-like, with entire rims.

h. Premaxillary patch of teeth not separated from the vomerine teeth by the maxillary series, which are widely separated anteriorly; teeth on sides of jaws in two even rows; vomerine teeth numerous, in a very long even file behind the canine. Ridge between maxillary teeth and upper lip with entire edge. Snout shorter, its fleshy tip scarcely projecting beyond the premaxillary teeth, and without ridge or keel on mid-ventral line.. *Uroconger.*

hh. Premaxillary patch of teeth separated from the vomerine teeth by the widely confluent maxillary bands; teeth on sides of jaws in narrow bands; vomerine teeth rather few and arranged as an A-shaped figure behind the large canine. Ridge between maxillary teeth and upper lip with the border finely fimbriate. Snout long, its fleshy tip projecting sharply beyond the premaxillary teeth, and with a ventro-anterior keel.. *Congrina.*

ANAGO Jordan and Hubbs, gen. nov.

Type: *Conger anago* Temminck and Schlegel.

This genus is very close to *Conger*, with which it is connected through *Congriscus*, but the teeth, though similarly disposed, are very different in shape, and the mouth is smaller, the dorsal fin inserted farther forward. From *Ariosoma* (*balearica*) and *Alloconger* (*flavirostris*, etc.), it differs in the arrangement of the teeth, and from *Gnathophis* in having all the teeth sharp.

155. [233] **Anago anago** (Temminck and Schlegel). *Anago* = Conger.

Misaki (Aoki); Mikawa Bay (M. Ishikawa); Toba (Jordan and Yamamoto); Tokyo market (Jordan). Generally common.

The three characteristic dark dashes on the side of the head are evident in a young specimen 15 cm. long, but not in one 12 cm. long.

CONGRISCUS Jordan and Hubbs. gen. nov.

Type: *Congromuræna megastoma* Günther.

This genus, which we define and compare with related types in the key, seems to stand directly between *Anago* and *Conger* in its technical characters.

156. [234] **Congriscus megastomus** (Günther). *Oki-anago* = Off-shore Conger.

Misaki.

Genus CONGER (Cuvier) Oken.

(*Leptocephalus* (Gronow) Scopoli; name assigned to larval forms.)

Two species of the Indo-Asiatic fauna may be retained in the typical genus *Conger*. One of these, *C. japonicus*, is interpreted by us as the representative of the Atlantic species, *C. conger*, while the other, *C. cinereus*, differs considerably in the point of origin of the dorsal fin.

157. **Conger cinereus** Rüppell.

Conger cinereus WEBER and DE BEAUFORT, Fishes Indo-Austral. Arch., III, 1916, p. 258, figs. 107, 108 (with entire synonymy excepting *Leptocephalus nystromi* Jordan and Snyder).

Leptocephalus riukiuanus JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1901, p. 852, fig. 4. (Okinawa).

This species, which has the dorsal fin inserted farther forward than in *Conger japonicus* or *Conger conger*, has been recorded from Japan proper by Günther and by Nyström as *Conger marginatus*, and a young specimen has been described as

Leptocephalus riukiuanus, from the Riu Kiu Islands. A comparison of this specimen with a large one from Samoa (called *marginatus*) reveals no evident differences.

158. [224, 228, and 231] **Conger japonicus** Bleeker. *Hama-anago* = Beach-conger.

Conger vulgaris Temminck and Schlegel, Fauna Jap., Pisces, 1846, p. 259.—Bleeker, Atl. Ichth., IV, 1864, p. 26, pl. 149, fig. 2 —Günther, Cat. Fishes Brit. Mus., VIII, 1870, p. 70 (in part). (Not of European authors.)

Conger japonicus Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 32, pl. 2, fig. 2.

Leptocephalus japonicus Jordan and Snyder, Proc. U. S. N. M., XXIII, 1901, p. 851.

Leptocephalus erebennus Jordan and Snyder, *ibid.*, p. 849, fig. 3. (Misaki).

Leptocephalus kiusiuanus Jordan and Snyder, *ibid.*, p. 851. Nagasaki.—Snyder, Proc. U. S. N. M., XLII, 1912, p. 406.

Conger conger Weber and de Beaufort, Fishes Indo-Austral. Arch., III, 1916, p. 259.

Three specimens from Misaki (Aoki).

Conger japonicus Bleeker is doubtless based on the young of the conger later described as *L. erebennus* and *L. kiusiuanus* by Jordan and Snyder. On reexamining the types of the two nominal species we fail to find any wide difference in the length of the trunk.

This is apparently also the species referred by Schlegel, Bleeker, and Weber to the Atlantic *Conger conger.* Indeed on comparison of material we find no constant differences in proportions, coloration, or dentition. There appears, however, to be a difference in the number of pores in the lateral line on the trunk (and the pores correspond in number to the body segments). Between the verticals from the origin of the pectoral and the anus we count 33 to 35 pores in six Japanese specimens: 36 to 37 in one from Beaufort, North Carolina, and 40 in another from the same locality; 39 to 41 in two from the Canary Islands, and 39 to 40 in three from Naples.

ASTROCONGER Jordan and Hubbs, gen .nov.

Type: *Anguilla myriaster* Brevoort.

This common Japanese conger, known currently as *Leptocephalus myriaster*, must be taken as the type of a genus distinct from *Conger*, on account of the very extensive development of sensory pores. The series of pores along the back is, so far as we know, not developed in any other eel.

159. [227] **Astroconger myriaster** (Brevoort). *Ma-anago* = True-conger.

Misaki (Aoki); Fukuoka (Hamada); Mikawa Bay (Ishikawa); Tokyo, Yokohama, and Osaka markets (Jordan); Fukui (Nonaka). Generally common everywhere in the markets.

ALLOCONGER Jordan and Hubbs, gen. nov.

Type: *Leptocephalus flavirostris* Snyder.

This genus seems similar to *Ariosoma* Swainson[61], but it at least differs in having the premaxillary teeth largely exposed. It is compared with the other Japanese genera of conger-eels in the preceding key, and the remarks there given will serve as its definition.

160. [230] **Alloconger flavirostris** (Snyder).

Leptocephalus flavirostris SNYDER, Proc. U. S. N. M., XXXV, 1908, p. 93; *ibid.*, XLII, 1912, p. 405, pl. 51, fig. 1 (Misaki).

Alloconger flavirostris is very close to the East Indian species, *A. anagoides* (Bleeker), of which we have examined the Formosan material recorded by Jordan and Richardson in 1909[62], and to the Hawaiian species, *A. bowersi* (Jenkins), which we also have at hand. It seems to differ from both species in having the teeth smaller and more numerous.

In the paratype of *A. flavirostris* there are about fifty pores before the anus.

RHYNCHOCYMBA Jordan and Hubbs, gen. nov.

Type: *Leptocephalus nystromi* Jordan and Snyder.

The definition and comparisons of *Rhynchocymba* may be found in our generic analysis given above.

161. [226] **Rhynchocymba nystromi** (Jordan and Snyder).

In working out the generic diagnosis of *Rhynchocymba* we have used the typical material of this species. In describing *Leptocephalus nystromi* Jordan and Snyder compared it only with the very distantly related *Leptocephalus marginatus* = *Conger cinereus*, and referred Günther's and Nyström's Japanese records of

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[61] The group of conger-eels typified by *Murœna balearica* De la Roche of the Mediterranean Sea has successively received the names *Ariosoma* Swainson, *Ophisoma* Swainson, *Congermurœna* Kaup, and *Congrellus* Ogilby. The first restriction of *Ophisoma* by Bleeker, 1864, to *O. acuta* Swainson (= *balearica*) carries its synonym *Ariosoma* with it. To the Congers with blunt teeth of the type of *Conger habenata*, the name *Gnathophis* Kaup, based on *Myrophis heterognathus* Bleeker from Nagasaki is apparently applicable.

[62] Mem. Car. Mus., IV, 1919, p. 171

Conger marginatus to their new species, making no reference to the dentition. This circumstance has led Weber and de Beaufort (1916) to refer *nystromi* improperly to the synonymy of *Conger cinereus*.

The species is doubtless different from *Myrophis heterognathos* Bleeker, type of *Gnathophis* Bleeker, whatever the latter may be, though the last version gives it the blunt teeth of *Conger habenatus*.

RHYNCHOCONGER Jordan and Hubbs, gen. nov.

Type: *Leptocephalus ectenurus* Jordan and R. E. Richardson.

This genus with *Rhynchocymba* and *Congrina* have many characters in common with *Congermurœna nasica* Alcock, the type of *Bathycongrus* Ogilby, but all seem to differ generically. Unfortunately we have no specimens of Alcock's species.

162. [Extraterr.] **Rhynchoconger ectenurus** (Jordan and Richardson).

Leptocephalus ectenurus JORDAN and R. E. RICHARDSON, Mem. Car. Mus., IV, 1909, p. 171, p. LVI, lower figure.

We have studied the type of this Formosan species.

Genus UROCONGER Kaup.

This genus has long been separated from *Conger* or *Leptocephalus*, but it is no more distinct than most of the genera we have just characterized.

163. [226A] **Uroconger lepturus** (Richardson).

Leptocephalus retrotinctus SNYDER, Proc. U. S. N. M., XLII, 1912, p. 405 (Kagoshima). (Not of Jordan and Snyder.)

Failure to consider the dentition has led Snyder to refer specimens of *Uroconger lepturus*, a well known Chinese and East Indian eel from Kagoshima, to *Leptocephalus retrotinctus* Jordan and Snyder (= *Congrina retrotincta*). We have reexamined this material. One specimen has the tail unusually short (only 1.4 times the head and trunk), and the caudal fin is extremely large and base broad. These facts would seem to indicate that the extremely attenuate tail normally developed in this species is subject to injury, but that after loss it regenerates a pseudo-caudal fin, as in the macrouroid fishes.

CONGRINA Jordan and Hubbs, gen. nov.

Type: *Congermurœna æquorea* Gilbert and Cramer.

This genus is defined in our generic analysis given above.

164. [229] **Congrina retrotincta** (Jordan and Snyder).

Leptocephalus retrotinctus JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1901, p. 853, fig. 6 (Tokyo Market).

A specimen 461 mm. long to caudal was taken by Aoki at Misaki.

Snyder's record of *Leptocephalus retrotinctus* from Kagoshima refers to *Uroconger lepturus.*

Congrina retrotincta is extremely close to *Congrina æquorea,* the type-species of the new genus *Congrina.* On comparison it seems to differ in having the head shorter and the teeth perhaps a little stronger and fewer. In all the characters given in the key the two species are alike.

The type of *L. retrotinctus* was described as having the snout blunt, which is true of that specimen, but the bluntness is due, we now find, to the fact that the protruding fleshy tip had been broken off or torn away. As the type was not only injured, but young, we have prepared the following description of our adult specimen:

Body fairly robust, about as wide as deep anteriorly, but posteriorly becoming compressed, tapering to a very slender tail. Postorbital region tumid. The bluntly conic snout projects well beyond mouth, its preoral length being nearly equal to orbital length. Greatest depth of body 2.45 in head, 17.7 in total length to caudal. Head, 7.75 in total length, 1.7 in trunk, 4.4 in tail. Distance from dorsal fin to occiput 2.8 in head; highest dorsal ray, 3.15; length of caudal, 7.4; length of pectoral, 3.65; snout, 3.55; eye, 6.65; interorbital width (fleshy), 6.15; gape, 3.2; width of head, 2.7. Head and trunk together 1.85 in tail. Origin of dorsal fin a little behind base of pectoral; pectoral fin rounded. Teeth of jaws coarse and irregular, in narrow bands; vomerine teeth few, one greatly enlarged, conic, sharp, somewhat curved backward, preceded by two in line, much smaller, the first scarcely canine-like; followed by a group of three teeth forming an isosceles triangle with the apex pointing backward; premaxillary teeth about thirteen in number, enlarged, canine-like posteriorly along front of gape. Tip of snout with a large deep pit on each side just in front of the anterior nostrils, which open in a short tube; a series of five longitudinal slits runs from just behind the anterior nostril to below middle of eye; the posterior nostril is a horizontal slit with scarcely elevated rims, located just before and a little above the horizontal through middle of pupil. Other pores occur near tip of chin and a pair on the lower surface of the snout just in front of the premaxillary cluster of teeth and on each side of a fleshy keel; lips rather full laterally; the upper narrow, separated by a fringed fold from maxillary band of teeth; lower lip thicker and more pendant; gill-openings extending downward and forward from the middle of the pectoral base to within their own length apart. Lateral line a rather wide ridge, originating abruptly at side of nape, running a little above midline of sides on anterior half of body, a little below the mid-line posteriorly; seventh pore above pectoral base; eighth and ninth on each side of the vertical from dorsal origin, thirty-ninth above the anus.

Color dusky above, rather abruptly pale below; pectoral fin whitish, with a dusky blotch above its center; vertical fins pale anteriorly with a dusky base, which soon widens, especially on the dorsal fin to exclude the pale color from all but the margin.

Family MURÆNESOCIDÆ.

165. [235] **Murænesox cinereus** (Forskål). *Hamo.*

Tokyo, Kyoto, and Kobe markets (Jordan). Not rare in the markets and reaching a considerable size.

Outer mandibular teeth not directed outward; vomerine teeth broad, with strong basal lobes.

Family OPHICHTHYIDÆ.

166. [243] **Pisoödonophis zophistius** Jordan and Snyder.

One adult and two young, Mikawa Bay (Ishikawa); two, Misaki (Aoki).

On comparison of material we find that *P. zophistius* differs from the East Indian *P. cancrivorus* in having the dorsal much higher and more darkly colored anteriorly, in the much smaller size of the two barbels on the upper jaw, and in the smaller eye, which is two-fifths instead of half as long as the snout. The pores of the head, however, are alike in the two species.

167. [254] **Ophisurus macrorhynchus** Bleeker. *Umi-hebi* = Off-shore Snake.

Mikawa Bay (Ishikawa).

Family MURÆNIDÆ.

168. [258] **Gymnothorax reticularis** Bloch. *Utenbo* = Moray.

Misaki (Aoki). None of the other Morays, numerous about Kyūsyū, were obtained in 1922.

Family CYPRINODONTIDÆ.

Genus ORYZIAS Jordan and Snyder.

Regan[63] and Weber have identified *Oryzias* Jordan and Snyder with *Aplocheilus* (usually, but not at first, written *Haplochilus*). Günther, in referring the types of *Aplocheilus* and *Panchax* to the same species, was certainly in error.

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[63] Ann. Mag. Nat. Hist., (8) VII, 1911, p. 324.

The group, called *Oryzias* Jordan and Snyder, is the Indian genus *Aplocheilus* McClelland, as first restricted by Bleeker to *Aplocheilus melastigmus* McClelland. In a recent paper upon these fishes Dr. Ernst Ahl[63a] recognizes *Oryzias* as a distinct genus, as it lacks enlarged teeth on the sides of the premaxillary, these being characteristic of *Aplocheilus*. The teeth in *Oryzias* are very small and slender.

169. [268] **Oryzias latipes** (Temminck and Schlegel). *Medaka* = High-eyes.

Kachi River at Nagoya (Jordan); brook at Yamawa near Kagoshima (Wakiya); Aomori (Beppu); Lake Biwa (Jordan); Lake Kasumigaura (Hattori).

A little inhabitant of ditches in the rice-fields.

170. [269] **Pseudorasbora parva** (Temminck and Schlegel).

The genus *Fundulichthys* Bleeker has been shown by Mr. George S. Myers to have no real existence, its type-species *Fundulus virescens* Temminck and Schlegel, being founded on a bad figure of *Pseudorasbora parva*.

Family NOTACANTHIDÆ.

171. [270] **Polyacanthonotus challengeri** (Vaillant).

The names *Polyacanthonotus* Bleeker, Versl. Akad. Amst., (2) VIII, 1874, p. 368 (type *Notacanthus rissoanus* De Filippi and Verany) and *Zanotocanthus* Gill, Johnson's Cyclopedia, III, 1876, p. 883 (the same type) have priority over *Macdonaldia* Goode and Bean.

Family SYNGNATHIDÆ.

172. [274] **Syngnathus schlegeli** Kaup. *Yoji-uwo* = Tooth-pick fish.

Bay of Mikawa (C. Ishikawa); Misaki (Aoki).

173. [287] **Hippocampus japonicus** Kaup. *Kitano-uma-umi* = Northern Sea-horse.

Enoshima (Jordan).

174. [288] **Hippocampus coronatus** Temminck and Schlegel.
Uma-umi = Sea-horse; *Tatsu* = Dragon.

Enoshima (Jordan).

Family AULORHYNCHIDÆ.

175. [291] **Aulichthys japonicus** Brevoort. *Kuda-yagara* = Pipe-Yagara.

Misaki (Aoki).

[63a] Ahl, Zoöl. Anz., May 1924, p. 50.

Family FISTULARIIDÆ.

176. [292] **Fistularia petimba** Lacépède. *Aka-yagara* = Red Yagara.

Shizuoka market (Jordan); Toba market (Jordan and Yamamoto); Kagoshima Bay (Wakiya).

177. [293] **Fistularia serrata** Cuvier. *Ao-yagara* = Green Yagara.

Osaka market (Jordan); Toba market (Jordan and Yamamoto); Misaki (Aoki); Mikawa Bay (M. Ishikawa).

Family MACRORHAMPHOSIDÆ.

178. [295] **Macrorhamphosus sagifue** Jordan and Starks. *Sagifue* = Egret-piper.

Ten specimens from Misaki (Aoki).

Depth, 3.75 to 4.1. Dorsal spine serrated, inserted well before anus, when depressed reaching beyond base of caudal. Regan[64] has lately well reviewed the species of this genus.

Family GASTEROSTEIDÆ.

Genus GASTEROSTEUS Linnæus.

The three-spined Sticklebacks have long been known to be among the most variable of all fishes, and they have been referred to a large number of nominal species. We have examined many series representing localities in all the northern continents.

The marine form of northern Europe, *G. aculeatus* = *G. trachurus* of Greenland and the northern Pacific on both sides, *G. loricatus*, *G. cataphractus* = *obolarius* = *insculptus*, seem not to be separable into local species or subspecies. This form is characterized by the large size attained, by the complete development of lateral plates and caudal keel, the long, strong pubic plate, the long falcate pectoral fin, the serrate ventral spine, and the high average number of dorsal and anal rays.

Up the streams and southward this circumarctic form, *G. aculeatus*, varies through a most complex and irregular, though complete, intergradation toward and into a very different type, both in Europe and on both sides of the North Pacific. The change involves a reduction in the adult size, a loss of lateral armature, a shortening of the pubic plate, a shortening and rounding off of the pectoral fin, and a reduction in the number of dorsal and anal fin-rays. The change, however, is not fully identical in the two oceans, for in Europe the loss of plates on the average is brought about more abruptly and from a more posterior point, so that intermediate types frequently have the plates irregularly absent in advance of the caudal keel which still persists; while in the Pacific the posterior plates become gradually shortened and eliminated together, so that the caudal keel is rarely evident, except in fully plated individuals. Moreover, the European stream-type, *G. leiurus*, has on the average stronger serrulations on the fin-spines than does the analogous Pacific form *G. microcephalus*.

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[64] Ann. Mag. Nat. Hist., (8) XIII, 1914, p. 17.

Toward the southern end of the range of *Gasterosteus* in both Europe and California a few especially distinct, almost wholly unarmed, races have been produced, as Regan has indicated.[65]

Of these the race inhabiting the Santa Ana system of streams of Southern California, *G. williamsoni* Girard = *santa-annæ* Regan[66] is particularly extreme, and has the fin-spines extremely short and posteriorly inserted. It is connected with *G. microcephalus* by a wholly intermediate type, occurring in neighboring waters both to the northward (Santa Clara River) and southward. It is closely analogous to *algeriensis* of northern Africa.

The occurrence of extensive and complete intergradation seems to call for the trinomial distinction of these forms. In the Pacific region we may recognize therefore three subspecies:

Gasterosteus aculeatus aculeatus Linnæus
Gasterosteus aculeatus microcephalus (Girard)
Gasterosteus aculeatus williamsoni (Girard).

The fully armed form of the western Atlantic (*biaculeatus*) and its partially plated fresh-water derivative (*cuvieri*) have not been thoroughly studied in the present connection, but the examples we have seen seem quite distinct from any of the forms of *G. aculeatus*. The junior author is accumulating material for a more exhaustive study of all the Sticklebacks.

Our Japanese specimens should be referred to two subspecies.

179. [297] **Gasterosteus aculeatus aculeatus** (Linnæus). *Hari-uwo* = Needle-fish.

Nineteen specimens from Kushiro, Hokkaido (Tanaka) represent a race with the body slenderer and the body-plates smoother than usual. Largest specimen 58 mm. long to caudal; plates and keel complete, but the posterior plates abruptly shortened; pubic plate long; pectoral long, narrow, and falcate; dorsal soft rays

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[65] Ann. Mag. Nat. Hist., (8) IV, 1909, pp. 435–437.

[66] The exact type-locality of *Gasterosteus williamsoni* is perhaps still in doubt, although Lieutenant Williamson is known to have crossed the Sierra Madre range at the head of the Santa Ana River, near Banning, California. Nevertheless the description leaves little doubt in regard to its identity with the form lately named *santa-annæ* by Regan. The number of vertebræ used by Regan is not constant, but may prove to be an average character of some value.

12 to 14, anal soft rays 9 to 11 (counting last ray as only partly divided). Depth of body, 4.2 to 4.8 in length to caudal.

180. [297A] **Gasterosteus aculeatus microcephalus** (Girard).
Harniko = Little Needle.

Fifteen specimens from Lake Biwa represent the partly plated Japanese form of *Gasterosteus aculeatus*. They seem wholly inseparable from specimens referred to *G. microcephalus* from California and the Aleutian Islands. Dorsal soft rays, 11 or 12; anal soft rays, 8 or 9; plates, 4 to 7.

Franz has named and figured Japanese specimens of this subspecies as *Gasterosteus williamsoni japonicus*. If the Japanese race should prove sufficiently distinct to be separated nomenclaturally, it will, however, require a new name, as both Houttuyn and Steindachner have used the combination *Gasterosteus japonicus*. There can be little doubt that these naked Sticklebacks of the rivers, however similar, have diverged independently from the marine form. As "ontogenetic species" they need not enter systematic lists.

Genus Pungitius Coste.

Pungitius Coste, 1846, replaces *Pygosteus* Gill, 1861.[67]

In the present connection we follow Berg's review[68] of the species of *Pungitius* in all respects but one. We refer the partially naked species of northern Japan to *P. brevispinosus* rather than to *P. pungitius*.

181. [298] **Pungitius sinensis** (Guichenot). *Harisaba* = Needle-mackerel.

Three specimens from Noo, Niigata-Ken, on the western side of Japan, have small plates along the entire course of the lateral line, and for this reason alone are referred to *P. sinensis*. As used by Berg, *P. sinensis* seems to us to be a complex of more or less unrelated races, which have developed plates along the lateral line anteriorly. Our specimens differ from those described by Jordan and Starks as *Pygosteus steindachneri*, and by Tanaka as *Pygosteus kaibaræ*, in having only one instead of two soft rays in the ventral fin (except on one side of one specimen). In *P. brevispinosus* and in specimens from Kamchatka referred to *Pungitius*, two rays are only occasionally evident in the ventral.[69]

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[67] See Jordan, Stanford Univ. Publ. (Biol.), III, 1923, p. 174.

[68] Proc. U. S. N. M. XXXII, 1907, pp. 451–454.

[69] We have examined large series of the Pacific forms of *Gasterosteus aculeatus*, but fail to find a single variant in the number of ventral rays (I, 1). In three paratypes of *G. gladiunculus* Kendall from Maine, however, we find two soft ventral rays on both sides of two specimens and on one side of the third. This well marked species is now regarded by Kendall as the original *G. bispinosus* Walbaum.

The six types of *Pygosteus undecimalis* (= *Pungitius tymensis*) at hand have no soft ventral rays at all, and one specimen lacks even the ventral spines. As Berg has remarked, Day has described and figured a local race of *Pungitius* from Ireland, which is closely comparable with *P. tymensis*.

The specimens from Noo have 8 or 9 dorsal spines.

182. [300 and 301] **Pungitius brevispinosus** (Otaki). *Ira-tomiyo*.

We refer to this species the specimens without anterior armature referred by Jordan and Starks to *Pygosteus steindachneri*, the Hokkaido specimens referred by Berg to *Pygosteus pungitius* and the material in the present collection, consisting of three specimens from Aomori (Beppu) and a series from Sapporo (T. Kawamura).

This form, which will probably prove to grade into *P. pungitius*, differs in having fewer dorsal spines, as the following table shows. In *P. pungitius* proper the number varies from 7 (abnormally as few as 2) to 12, 10 least frequently occurring.

Number of dorsal spines	VII	VIII	IX	X
Number of specimens	2	15	22	1

Specimens from Petropavlovsk, Kamchatka, seem to have the spines in about the usual number for *P. pungitius*.

Number of spines	IX	X	XI	XII
Number of specimens	4	28	9	1

Family EXOCŒTIDÆ.

Genus EXOCŒTUS Linnæus.

The name *Exocœtus* of Linnæus, included his species *E. volitans* (1758) and *E. evolans* (1766) both of which belong to the *Halocypselus*-type, having short ventrals not used for flight.

183. [303] **Exocœtus volitans** Linnæus. *Idaten-tori* = Swift bird.

One adult specimen, 6.5 inches long, was taken by Dr. Jordan at sea, about three hundred and fifty miles east of Yokahama.

It is evident that *Exocœtus volitans* of the Tenth Edition of the *Systema Naturœ* and *Exocœtus evolans* of the Twelfth Edition are both based on species with the ventral fins short, the group called *Halocypselus* by Weinland. Probably both names belong to the same species. But to what extent the species is cosmopolitan, and whether all forms of this type the world over belong to one species is problematical. The oldest name assigned to a Pacific member of this group seems to be *Exocœtus splendens* Abel, "Journ. China, 1818, 4."

The specimen noted above shows the following characters: Mouth unusually small; jaws and palate toothless; snout short, shorter than eye; scales 44; D. 13; A. 14; pectoral fin extending to last ray of dorsal; ventral twice in head, reaching half-way to anal; pectoral with the first ray long, not branched, reaching nearly to tip of fin; second ray slenderer, forked; dorsal fin low, anal a shade higher; upper caudal lobe unusually long, more than two-thirds length of lower. Color in life, plain dark blue above, center of scales a little darker; pectoral plain dusky, its basal half translucent, its edge narrowly white; dorsal plain olive; caudal plain dusky, and pure white; ventral white, its edge slightly dusky; length 6.5 inches.

This description discloses no differences on which an *Exocœtus splendens* could be differentiated as the Pacific representative of *E. volitans*.

184. [304, 306] **Cypselurus agoo** (Temminck and Schlegel).

Tobino-uwo = Bird-fish; *Agu.*

Cypselurus hirundo Jordan and Starks, Proc. U. S. N. M., XXVI, 1903, p. 542 (not *Exocœtus hirundo* Steindachner).

We provisionally identify as the young of this common Japanese Flying-fish eight specimens, 53 to 65 mm. long to the caudal fin, collected by Aoki at Misaki. They differ from the adult, as do the young of other species of the genus, in having the pectoral fins somewhat shorter, and in having a barbel at the tip of the chin. This barbel is short, constricted at its base but broadly expanded into a subtriangular black flap, having the lower edge uneven; the flap is about half as wide as the eye. The coloration is also wholly unlike that of the adult, and corresponds with the description given by Jordan and Starks in the account quoted above.

Our specimens agree entirely with the young identified by Jordan and Starks as *Cypselurus hirundo*. It is certain, however, that they are specifically different from Steindachner's fish, also described from a young specimen. The young of *Cypselurus hirundo* differs widely in coloration and in the character of the barbels: "Die Unterlippe ist verdickt und endigt jederseits in einige zarte Tentakeln von geringer Länge."

185. [307] **Exonautes brachycephalus** (Günther).

A young flying fish, 74 mm. long to the caudal, obtained by Aoki at Misaki, Japan, probably belongs to this species. At least it appears to be identical with the Japanese specimen 107 mm. long referred by Jordan and Starks[70] to *Cypselurus brachycephalus*.

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[70] Proc. U. S. N. M., XXVI, 1903, p. 539, fig. 2.

Head, 4.3; depth, 6.3; dorsal, 10; anal, 11; the two fins commencing at the same vertical (the type has two more rays in each fin, but the specimen described by Jordan and Starks is intermediate). Snout short and not produced, only two-thirds as long as the orbit, which is contained nearly three times in head; interorbital gently elevated toward orbital margins. Scales about 50 in lateral line, about 33 from occiput to dorsal fin, 7 between dorsal fin and lateral line; ridge of lateral line not more than usually conspicuous. Pectoral fin extending to opposite tips of last dorsal and anal rays, when depressed; ventral fin extending a little farther, but not quite to caudal base; the structure of the rays of the paired fins is as described by Jordan and Starks. There is no trace of a barbel.

Body clear light brown above, darkest on snout and caudal base, light below. Dorsal with a large and conspicuous black spot; anal fin clear; lower margin of upper caudal lobe and greater portion of lower lobe darkened, as also in the larger Japanese specimen; ventrals mostly black, pale around the margin; pectoral light in the rays, but deep brown on the membranes, except along the lower edge of the fin, on a large oblong area near middle of fin and on a large triangle between the oblong and the tip of the fin; these specified areas without pigment.

Family HEMIRAMPHIDÆ.

186. [310] **Hyporhamphus sajori** (Temminck and Schlegel). *Sayori.*

Sapporo market (Majima); Otaru market (Takayasu); Tokyo, Osaka, and Nagoya markets (Jordan); Mikawa Bay (M. Ishikawa); Toyama, Miyazu, Misaki (Aoki). Generally common throughout Japan.

This species reaches a length of at least 26 cm. (measured from tip of premaxillaries to caudal base).

187. [312] **Hyporhamphus kurumeus** (Jordan and Starks).

Kachi River at Nagoya (Jordan); Lake Kasumigaura, north of Tokyo (Hattori). These are the first records of the species from Hondo, the main island of Japan, the types having been obtained in Chikugo River, Kyūsyū, and no specimens having been subsequently reported.

Dorsal rays, 15; anal, 17; scales, about 80 to 90 (deciduous, very difficult to count, given as about 70 in the description of the type, but we may count more than 80 in the types); origin of anal a little in advance of that of dorsal.

Family SCOMBRESOCIDÆ.

188. [315] **Cololabis saira** (Brevoort). *Samma*; *Saira*.

Tokyo market, Nagoya market (Jordan); Kushiro (Takayasu); Misaki (Aoki). Very abundant everywhere and much valued as food.

Mr. Hubbs[71] has lately indicated that the Californian form, *C. brevirostris*, is not tangibly different from the Japanese *saira*, which was first named.

Family BELONIDÆ.

189. [316] **Tylosurus anastomella** (Cuvier and Valenciennes). *Datsu* = Gar-fish.

Miyazu; Fukuoka (Hamada).

190. [317] **Tylosurus schismatorhynchus** (Bleeker). *Hama-datsu* = Shore Gar-fish.

Kobe market (Jordan); Toyama, Sea of Japan (S. Yoshizawa). Not rare.

Family SPHYRÆNIDÆ.

191. [320] **Sphyræna japonica** Cuvier and Valenciennes. *Kamasu* = Barracuda.

We have one adult specimen of the large Barracuda from the Tokyo market (Jordan) and seven young from Misaki (Aoki). Jordan and Snyder in 1900 took the species at Nagasaki.

Head, 2.8 to 3.3; depth, 7.2 to 8.2; depth of caudal peduncle, 4.6 to 5.7 in head; eye, 4.9 to 5.9; snout, 2.2 to 2.4; interorbital, 5.1 to 5.7; upper jaw, 2.2 to 2.4. Dorsal, V–I, 9; anal, II, 8; scales, 12–111 to 125–14. Ventral inserted under origin of first dorsal, a little behind tip of pectoral, or at a distance from anal origin contained 3.6 times in the length to caudal. Preopercular margin squarish. Color dark; the mouth parts largely black.

192. [322] **Sphyræna pinguis** (Günther). *Kamasu* = Good Salmon (Barracuda).

Kyoto and Kobe markets (Jordan); Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa); Miyazu, Fukuoka (Hamada).

This small Barracuda is generally common in the markets and much valued as a pan-fish.

Records of *Sphyræna obtusata* from Japan probably refer to this species, which seems different from true *S. obtusata*.

Head, 3.1 to 3.4; depth, 6.2 to 7.5; depth of caudal peduncle, 4.0 to 4.5 in head; eye, 4.6 to 5.6; snout, 2.2 to 2.4; interorbital, 5.1 to 6.0; upper jaw, 2.4 to 2.6. Dorsal, V–I, 9; anal, II, 8; scales 8 to 10—80 to 90—11 to 12. Ventral inserted under middle of pectoral; pectoral not quite reaching vertical from dorsal origin; distance between insertion of ventral and origin of anal one-third the length to caudal. Preopercular margin squarish, somewhat produced backward at angle.

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[71] Publ. Zoöl. Univ. Cal., XVI, 1916, p. 157.

Family OSPHRONEMIDÆ.

193. [Extraterr.] **Macropodus opercularis** (Linnæus).

Three specimens obtained from Professor Yosiro Manabe, taken at Okinawa, Ryūkyū Islands.

Dorsal rays XIII or XIV, 8; anal XX, 14 or 15. Soft dorsal and anal lobes considerably produced and sharp; caudal lobes not at all, or only slightly, produced; soft dorsal rays branched, anal rays unbranched. Vertical fins ensheathed by scales at their bases.

Material of this species from Soo-chow, China, has been sent to the Museum of Zoölogy, University of Michigan, by Dr. Cora B. Reeves.

Family OPHICEPHALIDÆ.

194. [Extraterr.] **Ophicephalus argus** Cantor.

Specimens of this common Chinese fish were obtained by Professor Gee at Soo-chow, China.

Family ATHERINIDÆ.

195. [323] **Atherina bleekeri** Günther.

Bay of Kagoshima (Wakiya).

196. [325] **Atherina tsurugæ** Jordan and Starks.

Gin-iso-iwashi = Silvery Surf-sardine.

Two silver-sides referable to *Atherina tsurugæ* were given to Dr. Jordan by Mr. Mikimoto, who obtained them at his pearl-plantation on Tatoku Island.

Family MUGILIDÆ.

197. [328] **Mugil cephalus** Linnæus. *Bora* = Mullet.

Tokyo, Nagoya, and Osaka markets (Jordan); Kagoshima Bay (Wakiya); Mikawa Bay (Ishikawa); Fukuoka (Hamada); Lake Kasumigaura (Hattori); Misaki (Aoki). Everywhere excessively common in the markets.

The length of the gape is contained 1.15 to 1.3 times in the width of the mouth. Young, as small as 51 mm. to caudal, have three anal spines like the adult.

We are still unable to follow Günther and Oshima[72] in separating the common Striped Mullets into more than one species the world over. We find no specific differences in the form of the mouth in different regions, and such differences as may exist in the number of scale-rows are slight and overlapping. In our material we count the transverse rows as follows: Naples, 39 to 43; Florida, 39; Texas, 38 to 40; Peru, 38 to 41; mouth of Colorado River, 38 to 41; Hawaii, 38 or 39; China, 38 to 41; Japan 36 (rarely) to 41. In Formosan material, which he referred to two different species, Oshima counted 38 to 42 scale-rows.

Genus Liza Jordan and Swain.

Three species of *Liza* occur in Japan. They have lately been differentiated by Tanaka in a paper published in Japanese.[73] From a translation of this paper made by Mr. Kasawa, and an examination of two of the species (no specimens of *Liza akame* are in the collection), we have prepared the following key.

Key to Japanese Species of Liza.

a. Tip of pectoral not reaching vertical from origin of first dorsal.
  b. Back broad, depressed, not carinate; snout and eye only two-thirds as long as rest of head. Scales smaller, 37 or 41 in lateral series; depth of body about one-fifth of length to caudal...... *menada.*
  bb. Back narrower, compressed to a weak keel along mid-line; snout and eye nearly as long as rest of head. Scales larger, 35 or 36 in lateral series; depth of body, 3.85 to 4.5........... *hæmatocheila.*
aa. Tip of pectoral reaching vertical from front of first dorsal. Scales larger, 34 in lateral series; body very deep (the greatest depth 3.5 in length to caudal (after Tanaka) .... *akame*.

198. **Liza menada** Tanaka.

Liza hœmatochila Tanaka, Fig. Desc. Fishes Japan, VIII, 1912, p. 137, pl. 37–39 (not *Mugil hœmatocheilus* Temminck and Schlegel).

Liza menada Tanaka, Zoöl. Mag., No. 336, Oct. 15, 1917.

One specimen of this species, well figured by Tanaka as "Liza hæmatochila," is in the present collection. It was secured in the Nagoya market. Jordan and Snyder in 1900 took the species at Osaka, Wakanoura, Hiroshima, Hakodate, and the Ishikari River.

199. [329] **Liza hæmatocheila** (Temminck and Schlegel). *Menada.*

Three specimens are in the present collection, all from the Bay of Mikawa (C. Ishikawa). Seen in the markets of Yokohama and Osaka.

Jordan and Snyder took specimens in 1900 at Katase, Enoshima, and Wakanoura.

Not rare in markets, reaching a large size.

[72] Ann. Car. Mus., XII, 1919, p. 268; XIII, 1922, p. 240.

[73] Zoöl. Mag., No. 336, Oct. 15, 1917.

Family BERYCIDÆ.

200. [332] **Beryx splendens** Lowe. *Kimmedai* = Golden-eye Porgy.

Tokyo and Yokohama markets (Jordan).

Dorsal rays, IV, 13 to 15; anal, IV, 26 to 28; depth of body, 2.8 to 2.9 in length to caudal base; head, 2.7; scales with spinules arranged in quincunx order on each side of a central spineless groove, 9–67 or 68–19 in number; mouth bright red within.

We have no Atlantic material at hand for comparison.

201. [333] **Hoplostethus mediterraneus** Cuvier and Valenciennes.

Kagoshima Bay (Wakiya).

Family HOLOCENTRIDÆ.

202. [336] **Holocentrus spinosissimus** Temminck and Schlegel.
Ittodai = Head Porgy.

Toba market (Jordan and Yamamoto).

203. [340] **Ostichthys japonicus** (Cuvier and Valenciennes).
Ebisu-dai = Ebisu-porgy; Fish-god.

Tokyo market (Jordan); Kochi, Miyazu (Wakiya).

Family POLYMIXIIDÆ.

204. [343] **Polymixia japonica** Günther. *Ginme* = Silver-eye.

Polymixia japonica Günther, Ann. Mag. Nat. Hist. (4) XX, 1877, p. 436. —Steindachner and Döderlein, Denksch. Akad. Wiss. Wein, XLVII, 1883, p. 261, pl. 4, fig. 2.—Jordan and Fowler, Proc. U. S. N. M., XXVI, 1902, p. 18.

Shizuoka market (Jordan).

This species by oversight is currently credited to "Steindachner."

Family MONOCENTRIDÆ.

205. [344] **Monocentris japonicus** (Houttuyn). *Matsukasa-uwo* = Pine-cone-fish.

Misaki (Aoki). Commoner southward.

Family SCOMBRIDÆ.

This family, as now restricted, contains species of rather small size, with the spinous dorsal short, remote from the soft dorsal; the corselet indistinct; the vertebræ 31; the posterior without the "trellis-like" structure, produced by the union of hæmal processess; interspinal bones weak and slender; mouth large, with minute teeth. We recognize three genera, only one of them found in Japan proper.

a. *Scombrinæ.* Gill-rakers moderate, about 26; body fusiform; vomer and palatines toothed; vertebræ 31.
  b. Air-bladder wanting. Atlantic...*Scomber.*
  bb. Air-bladder well-developed...*Pneumatophorus.*
aa. *Rastrelligerinæ.* Gill-rakers very long and numerous, feathery, about 57, filling the mouth; body compressed; no teeth on vomer or palatines. South Seas.............................*Rastrelliger.*

In arranging the species of Mackerels and Tunnies of our collections in Japan, we have rather closely followed the determinations given in the elaborate and painstaking monograph of Dr. Kamakichi Kishinouye, entitled "Contributions to the Comparative Study of the So-called Scombroid Fishes," Journ. Agri., Imp. Univ. Tokyo, March, 1923.

Dr. Kishinouye divides the old family *Scombridæ*, on the basis of skeletal and muscular characters into four, which seem to be well-defined and are certainly natural groups. He also adds certain new genera, as given below.

Genus PNEUMATOPHORUS Jordan and Gilbert.

Pneumatophorus JORDAN and GILBERT, Proc. U. S. N. M., V, 1883, p. 593 (as subgenus).—STARKS, Science, LIV, 1921, p. 222 (elevated to generic rank).

The Chub-mackerels have until lately been usually regarded as comprising a single cosmopolitan species, called *Scomber colias* or *Scomber japonicus*, the latter name being the earliest. Evermann and Kendall[74] found certain differences in their material and consequently recognized two species, *colias* and *japonicus*. In 1922 Starks[75] further compared specimens from California and Massachusetts. In the meantime, however, Tanaka[76] had recognized the existence of two distinct species in Japan, distinguishing *Scomber tapeinocephalus* Bleeker from the commoner species *S. japonicus*.

A more extended comparison of these mackerel from various parts of the world has obviously been needed. We have with the aid of Masunosuke Kasawa, a student from Sapporo, examined all of the specimens at our disposal. This material seems to comprise seven species, of which two are represented in Japan. and so far as we know, confined to the waters of that country. They are *P. tapeinocephalus* and *P. japonicus*. Besides these we have specimens from Australia, Hawaii, and Socorro Island, off the Coast of Mexico, which seem to belong to a Polynesian species, which may be provisionally known by the old name

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[74] Proc. U. S. N. M., XXXVIII, 1910, p. 327.

[75] Copeia, No. 103, 1922, p. 9.

[76] Zoöl. Mag., XXIX, 1917, p. 347.

australasicus of Cuvier and Valenciennes. The other species are nearer *japonicus*. Each of them occupies a special faunal area: *P. colias* European; *P. grex* Western Atlantic; *P. peruanus*, sp. nov., Peru; and *P. diego* California. Seven species are contrasted in the following key.

KEY TO THE SPECIES OF PNEUMATOPHORUS.

a. Dorsal spines 11 or 12; scales fewer than 200 in the lateral line. Gill-rakers 25 to 27 on lower limb of outer arch.

  b. Scales between occiput and first dorsal fin, 35 to 45; scales between origin of second dorsal fin and lateral line, 19 to 23; length of head .285 to .295 of length to caudal base; distance from tip of snout to first dorsal, .365 to .38; distance from tip of mandible to ventral fin, .345 to .355. *australasicus*.[77]

  bb. Scales between occiput and first dorsal fin, 24 to 32; between second-dorsal and lateral line, 15 to 19; length of head, .275 to .285 of length to caudal; snout to dorsal, .355 to .36; mandible to ventral, .33 .... *tapeinocephalus*.

aa. Dorsal spines 9 or 10; scales more than 200 in the lateral line (186 to 209 in *P. grex*).

  c. Gill-rakers 29 to 32 on lower limb of outer arch. Scales along lateral line, 200 to 229; scales from occiput to dorsal fin, 39 to 50; scales from origin of second dorsal fin to lateral line, 20. Measurements in hundredths of length from tip of snout to base of caudal: length of head, .28 to .295; snout, .09 to .095; upper jaw, .105 to .115; snout to dorsal, .37 to .385; mandible to ventral, .335 to .38 .... *colias*.[78]

  cc. Gill-rakers 23 to 28 on lower limb of outer arch.

    d. Scales in lateral line, 186 to 209; before first dorsal fin, 34 to 41; from origin of second dorsal to lateral line, 19 to 21. Gill-rakers, 23 to 27. Measurements in hundredths of length to caudal fin: length of head, .27 to .28; snout, .085 to .09; upper jaw, .10 to .105; snout to dorsal, .36 to .37; mandible to ventral, .325 to .34 .... *grex*[79]

    dd. Scales in lateral line, 205 to 231; before first dorsal fin, 40 to 60. Gill-rakers, 26 to 29.

      e. Measurements in hundredths of length to caudal base: head, .275 to .29; snout, .09 to .095; upper jaw, .10 to 115; snout to dorsal ,.355 to .375; mandible to ventral, .325 to .35.

        f. Scales between the second dorsal fin and lateral line 19 to 26, usually fewer than 23. *japonicus*.

        ff. Scales between the second dorsal fin and lateral line 22 to 27, usually more than 23. *diego*.[80]

      ee. Measurements in hundredths of length to caudal base: head, .29 to .32; snout, .095 to .105; upper jaw, .115 to .135; snout to dorsal, .38 to .405; mandible to ventral, .365 to .375. *peruanus*.[81]

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[77] Specimens from off Moreton Bay, Queensland; Lord Howe Islands (near Australia); Hawaii; Socorro Island, off the west coast of Mexico.

[78] Diagnosis based on a specimen from Naples, and one of three from the Canary Islands.

[79] Diagnosis based on a series of adults from Woods Hole.

[80] Diagnosis based on series of adults from California.

[81] *Pneumatophorus peruanus* Jordan and Hubbs, sp. nov. Type-specimen 201 mm. long to the caudal fin, from the Bay of Callao, Peru; collected by the late Admiral L. A. Beardslee; Cat. No. 6218, Stanford University Collection, C. M. Cat. Fishes No. 7847. Paratypes are from the same locality and from the Galapagos Islands.

206. [345, in part] **Pneumatophorus tapeinocephalus** (Bleeker).

Marusaba = Round Mackerel.

Scomber tapeinocephalus Bleeker, Nat. Tydsk. Ned. Ind., VI, 1854, 407 (Nagasaki).

Tatoku Island (Mikimoto). Jordan and Snyder (in 1900) took this species at Hakodate, Tateyama, Kobe, and Matsushima, though not distinguishing it at the time from the common mackerel or *Saba*. It is nowhere abundant.

207. [345] **Pneumatophorus japonicus** (Houttuyn).

Saba = Mackerel; *Hirasaba* = Broad Mackerel; *Gomasaba* = Oil Mackerel.

Sapporo, Takashima, Tokyo, and Shizuoka markets (Jordan); Kushiro; Misaki; Miyazu; Yokohoma; Kobe; Yamada; Hakodate; Nagasaki; Same; Matsushima. This is the common mackerel of Japan, found daily in abundance at every port.

In the markets, according to Kishinouye, there are three distinct forms of mackerel, which he regards as not definable as subspecies.

The usual shore-form, *Gomasaba* = Oil Mackerel, *Scomber pneumatophorus minor* Schlegel, has gray spots below the lateral line, and the dark markings of the back do not cross the line which is marked by a row of round spots. The *Hirasaba*, or Flat Mackerel (variety *major*) of Schlegel has but nine dorsal spines, while the *Marusaba*, or Round Mackerel (*Scomber tapeinocephalus* Bleeker) has eleven or twelve. In the *Hirasaba*, the dark streaks on the back cross the lateral line, and the caudal is yellowish.

The "*Marusaba*" is the species named *Scomber tapeinocephalus* by Bleeker. The others correspond respectively to the *Scomber pneumatophorus major* and *minor* of Schlegel, *Scomber saba*, and *Scomber janesaba* of Bleeker. The *marusaba* is no doubt a distinct species, and the others may prove to be so.

The scanty descriptions of *Scomber japonicus* and *Scomber auratus* in the original paper of Houttuyn are identifiable only on the supposition that but one species of mackerel with eight or nine spines occurs at Nagasaki.

Family CYBIIDÆ.

This family comprises the allies of the Spanish Mackerel of America, the Seer-fishes, or *Sawara* of Japan. It is visibly characterized by the many-rayed first dorsal, which extends nearly to the front of the second. Body compressed; mouth large; teeth strong, in one row, usually more or less compressed; lateral line sinuous, often branched or duplicated; vertebræ 31 to 64, usually more than 40; interhæmels well developed, usually long and numerous; gill-rakers small and few, sometimes wanting, not more than 13 in number. Besides the living genera, numerous others are characteristic of the Miocene of California. The following are recognized: *Ocystias, Thyrsocles, Turio, Thyrsion, Zaphleges, Auxides, Zestias.* This group is probably the most primitive of the Mackerels.

Key to the Japanese Genera of Cybiidæ.

a. Acanthocybiinæ. Lamellæ of the gills reticulated, as in the Sword-fish; gill-rakers none; intermuscular bones inserted on the ribs; body elongate; teeth very strong, trenchant; vomer with teeth. Size very large .... *Acanthocybium.*
aa. Lamellæ of gills not reticulated; gill-rakers present; intermuscular bones inserted on vertebræ.
  b. Cybiinæ. Body elongate; teeth in jaws trenchant; teeth on vomer.
    c. Lateral line single; teeth compressed.
      d. Air-bladder present; lateral line simple.
        e. Gill-rakers three only .... *Cybium*
        ee. Gill-rakers 11 to 13 .... *Scomberomorus.*
      dd. Air-bladder wanting; lateral line with numerous short branches at right angles...... *Sawara.*
  bb. Sardinæ. Body plump; teeth not trenchant, their edges rounded, no teeth on vomer; lateral line simple; corselet at shoulder more or less distinct.
        f. Body scaly; tongue toothless; dorsal spines 18 to 22 .... *Sarda.*
        ff. Body naked outside of corselet; tongue and palatines with villiform teeth; dorsal spines 14 .... *Gymnosarda.*

Acanthocybium Gill.

This genus contains giant mackerels, differing considerably from the smaller forms, especially in the peculiar netted structure of the gills, as in the Sword-fish, *Xiphias.* There are no gill-rakers and the broad triangular serrated teeth resemble those of a shark. It might well be made type of a distinct family.

208. [355] **Acanthocybium sara** (Lay and Bennett).

Osawara, great *Sawara* or Seer-fish; *Okisawara* = Off-shore Sawara.

A valued food-fish, but from its huge size, eight to twelve feet in length, seldom preserved in collections. Teeth $\frac{18}{20}$ to $\frac{20}{25}$ on each side. The Hawaiian species, *Acanthocybium solandri* (Cuvier and Valenciennes) has much smaller teeth $\frac{50}{50}$ to $\frac{75}{60}$ on each side.

Cybium Cuvier.

This genus, of which the type is *Scomber commersoni* Lacépède, may perhaps be retained as distinct from *Scomberomorus* Lacépède, on account of the reduction in the number of its gill-rakers (1+2=3). The teeth are triangular and minutely serrated.

209. **Cybium commersoni** (Lacépède). *Ushisawara* = Cow-sawara.

This species, abundant in Formosa and southward is recorded from Japan proper by Kishinouye from a specimen taken at Yamaguchi. It was not seen by us.

Cybium commersoni may be separable from *Scomberomorus* by the few gill-rakers and serrulate teeth, as already indicated. *Sierra* Fowler (*cavalla*) has but eight gill-rakers, very strong teeth, and fifteen, instead of seventeen, dorsal spines; *Apodontis* Bennett (*immunis*) and *Chriometra* Lockington (*concolor*) have the teeth subconical and more numerous. These may represent one or two distinct genera. *Grammatorycnus* Gill (*bilineatus*) has two lateral lines and *Lepidocybium* Gill (*flavobrunneum*) has the lower teeth much enlarged, the dorsal spines but 12, and the finlets reduced to 4 or 5.

SCOMBEROMORUS Lacépède.

The name *Scomberomorus* of Lacépède cannot be set aside to be replaced by *Cybium* for the reasons assigned by Kishinouye. There seems to be no question that Lacépède's *Scomberomorus plumieri*, based on a rather poor copy of the painting of Plumier, which had previously been the basis of *Scomber regalis* Bloch, belongs to the species now called *Scomberomorus regalis*.

210. [354] **Scomberomorus sinensis** (Lacépède). *Hasa-sawara* = Toothed Sawara; *Inusawara* = Dog-sawara; *Ushi-sawara* = Cow-sawara.

This species is not rare in southern Japan, though less abundant than the common "Sawara." The original form of the specific name, *sinensis*, must replace *chinensis*.

Genus SAWARA Jordan and Hubbs, gen. nov.

Type: *Cybium niphonium* Cuvier and Valenciennes.

This genus differs from *Scomberomorus* in lacking the air-bladder, and in the presence of sharp branch canals placed at right angles along the course of the lateral line.

211. [353] **Sawara niphonia** (Cuvier and Valenciennes). *Sawara.*

Kobe market (Jordan).

The "Sawara" is an excellent food-fish, common everywhere southward, and valued for its rich and delicate flesh.

SARDA Cuvier.

Pelamys Cuvier and Valenciennes, name preoccupied.

212. [352] **Sarda orientalis** (Temminck and Schlegel).

Hagatsuwo = Toothed Albicore.

Not uncommon in the markets.

The species needs further comparison with *Sarda chilensis* of Chile and *Sarda lineolata* of California.

Genus GYMNOSARDA Gill.

213. [347] **Gymnosarda nuda** (Günther). *Isomaguro* = Surf-tunny.

Tokyo market (Jordan), one specimen, 29 cm. in length. It agrees well with the descriptions of Günther and Klunzinger, and has never before been noticed in Japan proper, although found in Formosa.

Dorsal XIV–12+VI; anal III–10+VI; eye 5.1 in head; pectoral 6.8. Scales present only on the corselet and along the lateral line, very thick and deeply imbedded. The last dorsal spine, which is almost imbedded in the skin, lies about midway between the preceding spine and the front of the second dorsal fin. Teeth uniserial in jaws, stronger below than above; lacking on the vomer, in a fine band on the palatines. Hæmal processes normal, showing no trace of the specialized structure seen in *Euthynnus*, *Katsuwonus*, and *Auxis*.

Body bluish black above, shading into silvery below, and showing no trace of dark stripes; cheeks silvery; opercles blackish; dorsal fins blackish, soft fin and finlets entirely white; pectoral dark; ventral black, except on the proximal half of the soft rays, which are white.

Family THUNNIDÆ.

This family, separated from the *Scombridæ* through the researches of Dr. Kishinouye, is thus characterized by him: "Cutaneous vascular system connected with a vascular plexus developed as sheets in the lateral line. Portions of the lateral muscle surrounding these sheets, situated on both sides of the vertebral column, dark red almost black in color. Another peculiar vascular plexus developed on the inner side of the liver or in the hæmal canal. Circulation of blood in the liver especially well developed."

For the Tunnies and Albacores, Kishinouye proposes a separate order, *Plecostei*, defined as "having a cutaneous vascular system, connected with the vascular plexus developed as sheets in the lateral muscle. Another peculiar vascular plexus is developed in the inner side of the liver or in the hæmal canal." These derivatives of the *Cybiidæ*, are regarded by Kishinouye as among the most specialized of fishes.

The *Plecostei*, as thus defined, contain two families, *Thunnidæ* and *Katsuwonidæ*. The first of these is thus described: "Body wholly covered with scales; second dorsal and anal with the anterior rays elevated; vertebræ 18+21=39; transverse process present; first vertebra short, anchylosed to the skull; alisphenoids meeting on the ventral median line; air-bladder present (except in one genus)."

KEY TO JAPANESE GENERA OF THUNNIDÆ.

- *a.* Cutaneous blood-vessels passing through the myotome of the fifth vertebra; surface of liver striated with fine venules.
  - *b.* Pectoral fin short, about half head, not reaching front of second dorsal; dorsal and anal lobes low. *Thunnus.*
  - *bb.* Pectoral fin very long, ribbon-like, reaching to the anterior dorsal and anal finlets, dorsal and anterior lobes moderate . . . . *Germo.*
- *aa.* Cutaneous blood-vessels passing through the myotome of the seventh vertebra; surface of liver not striated with venules.
  - *c.* Posterior cardinal vein not contiguous with the Cuvierian ducts. Vascular plexus on the inner side of the liver; pectorals long, reaching to near end of second dorsal, dorsal and anal lobes moderate, about half head . . . . *Parathunnus.*
  - *cc.* Posterior cardinal vein contiguous with the Cuvierian ducts; vascular plexus in the hæmal canal.
    - *d.* Air-bladder well developed, long and narrow; pectorals long, extending beyond middle of second dorsal; dorsal and anal lobes much elevated, as long as head; gill-rakers about 30. *Neothunnus.*
    - *dd.* Air-bladder wanting; gill-rakers about 26; pectoral fin shorter, reaching to near end of spinous dorsal; head shorter; mouth smaller . . . . *Kishinoella.*

THUNNUS South.

(*Thynnus* Cuvier, preoccupied; *Orcynus* Cuvier, preoccupied; *Albacora* Jordan.)

Pectoral fins very short, about two-thirds length of head; dorsal and anal lobes low.

214. [351] **Thunnus orientalis** Temminck and Schlegel. *Meguro*=Tunny; *Yoko.*

Orcynus schlegeli STEINDACHNER, Fische Japans, 1885, 178, taf. fig. 1 (Tokyo).

Kobe market (Jordan and Yamamoto); Misaki, young (Aoki).

This species, the young of which is locally known as *Yoko,* is rather common in the markets southward. It is said to reach a very large size. It needs comparison with its Californian cognate.

Dorsal finlets bluish; those of the anal dull yellowish; no yellow on fins; body plump, with narrow bars of silvery, the bars more or less broken into lines of dots, and especially conspicuous in the young. Dorsal XIII to XV–14, VIII or IX. Anal 13 to 15, VII to VIII. Gill-rakers 12+13=25.

This tunny is certainly *T. orientalis* of Schlegel, and we fail to note any characters by which *T. schlegeli* can be separated from it. Kishinouye takes the same view.

A stuffed specimen about six feet long, with the dorsal and anal lobes about half of head, is in the Fisheries Institute in Tokyo. The species may be identical with the Tunny of the Atlantic or the Tuna of the islands of California, but only comparison of material can decide. This and other species of *Maguro* (Tunnies) and *Shibi* (Albacores) are so large as to forbid preservation by ordinary collectors. They can best be studied in the field, in Japan and in Hawaii, where hundreds of specimens, ranging from five to ten feet in length are now daily brought into the markets. This condition has been well utilized in the recent studies of Dr. Kishinouye.

GERMO Jordan.

This genus, or subgenus, differs from *Thunnus* in the elongate, more or less ribbon-like pectoral fin, which is much longer than head, reaching at least to the second anal finlet. Internally *Germo* differs little from *Thunnus.*

Kishinouye does not accept the genus *Germo,* remarking: "many systematists put too much weight on the length of the pectorals, but it has little value in the classification."

The species of *Germo* are imperfectly known, the size of market examples making preservation difficult.

215. [349] **Germo germo** (Lacépède). *Tombo-shibi.*

A large Albacore was seen by Dr. Jordan at Shizuoka. It has the finlets black, edged with paler; dorsal lobe dusky, no yellow; dorsal black, its lobe one-third of head; body plump; snout rather long, longer than eye; pectorals very long, reaching second anal finlet. We follow Kishinouye in provisionally identifying the Japanese *Albacore* with *Germo germo* and *Thynnus pacificus* of the South Seas. But with the latter author we see no final certainty to be secured, except through comparison of material from Japan, Europe, California, and the South Seas. The Hawaiian Albacore, recorded provisionally by Jordan and Jordan as *Germo alalunga* is probably this species.

According to Fowler, the form *Scomber germon,* was earlier used by Lacépède.

PARATHUNNUS Kishinouye.

This genus is distinguished by internal characters, as already stated. The single recognized species has the pectoral fin elongate, though shorter than in

Germo; the lobes of the dorsal and anal moderate, about half length of head; free dorsal finlets eight only, the first being coalescent with the fin; body relatively robust.

216. [348 part] **Parathunnus sibi** (Temminck and Schlegel). *Shibi*; *Mebachi* = Wasp-eye; *Daruma-Shibi* = Chunky-shibi.

Thynnus sibi TEMMINCK and SCHLEGEL, Fauna Japonica, p. 97, pl. L. Common about Nagasaki.

Germo sibi JORDAN and JORDAN, Fishes of Hawaii, Mem. Car. Mus., X, 1922, 33.

Thunnus mebachi KISHINOUYE, Sui. Gak. I, 1915, 19; pl. I, f. III.

Parathunnus mebachi KISHINOUYE, Study of Scombroid Fishes, 442, 1923, figs.

Tokyo, Yokohama, Yamada, Kobe, Osaka; common in the markets.

With Mr. Kitahara we identify this species with the *Thynnus sibi* of Temminck and Schlegel. Kishinouye rejects this decision, as only the deep body (the depth about equal to length of head) and long pectorals form tangible points of resemblance. But he leaves *T. sibi* unidentified, while this common species would seem to have been unnoticed by previous authors. Besides the two points, admitted by Kishinouye, we may add another noted by Schlegel. The first dorsal finlet is joined to the last ray, leaving but eight which are free.

There is some discrepancy in the description of the color of the dorsal finlets. We found them dull yellow, each crossed by a rather broad, sharply defined, angular band of black, the edgings pale; dorsal lobes dull yellow; head with a marked brassy luster. Schlegel figures the finlets as dull yellow, describing them with the second dorsal and caudal as passing "vers leur extremité au fond olivâtre." Kishinouye merely says "finlets yellow," but figures them as having a faint dark margin. It may be that two species of this genus exist in Japan, distinguishable by the color of the finlets.

The generic name *Pelamys*, resurrected from Klein and Walbaum by Fowler, cannot be substituted for *Katsuwonus*, as Walbaum simply quotes from Klein, without indicating acceptance of the pre-Linnæan name. (See Opinion No. 5, International Commission of Zoölogical Nomenclature.)

NEOTHUNNUS Kishinouye.

Neothunnus KISHINOUYE, Studies, etc. 1923, p. 445. (*macropterus*).

This genus is characterized by anatomical features, as already indicated. Its type species is distinguished by the very high lobes of the dorsal and anal, the height of each being two-thirds as long as head; pectoral very long, almost as ribbon-like as in *Germo*. In the known species the finlets are bright yellow.

217. [350] **Neothunnus macropterus** (Temminck and Schlegel). *Kiwada*; *Kihata.*

The Yellow-fin Albacore, found also in Hawaii and in California, is known at once by the clear lemon-yellow finlets, not edged with black, and by the very high lobes of the dorsal and anal, which are largely yellow.

It is the most abundant of the Japanese Albacores; generally common in the larger markets.

KISHINOELLA Jordan and Hubbs, gen. nov.

Type: *Thunnus rarus* Kishinouye.

This genus differs from *Neothunnus* in the absence of the air-bladder. In the type species, the pectoral fin is of moderate length, scarcely as long as the head; dorsal and anal lobes moderate; body fusiform; mouth small; finlets nine above; gill-rakers about 21.

The single species is the smallest of the group of Albacores.

218. **Kishinoella rara** (Kishinouye). *Koshinaga.*

Rarely taken off southern Japan, and not seen by us. Finlets yellowish, with a greyish margin; tip of second dorsal and anal washed with yellow.

Family KATSUWONIDÆ, Kishinouye.

This family comprises small tunnies in which the hæmal bones posteriorly are united below, forming what Lütken calls a "trellice-like" structure; air-bladder wanting; teeth weak, one-rowed; pectorals short; soft dorsal and anal low, elevated in front. Various internal characters are noted by Kishinouye, who divides the group into three genera.

KEY TO GENERA OF KATSUWONIDÆ.

a. First dorsal long, reaching base of second; a pair of foramina on the dorsal surface of the skull; inferior foramen of vertebræ well developed, forming a well-marked trellice.
  b. Hypaxial as well as epaxial blood-vessels under the skin well developed; teeth in jaws only; vertebræ 41 .... *Katsuwonus.*
  bb. Hypaxial blood-vessels atrophied; teeth on jaws, palatines, and sometimes on vomer; vertebræ 49. *Euthynnus.*
aa. First dorsal short, well separated from the second; hypaxial blood-vessels atrophied; lower foramen of vertebræ little developed; teeth in jaws only; vertebræ 49; epihæmal spines well developed. *Auxis.*

219. [347] **Katsuwonus vagans** (Lesson).
Katsuwo = Victor-fish; *Magatsuwo* = True Katsuwo.

Generally common southward. Kishinouye and authors generally apply to this species the name of the "Oceanic Bonito" of the Atlantic, which also occasionally is taken on the coast of southern California. It needs comparison with

Mediterranean examples of *Katsuwonus pelamis* (Lesson). In our record of the fishes of Hawaii (p. 31) we have called this fish, the "Aku" of Hawaii, *Euthynnus pelamis*, but its generic separation from *Euthynnus* seems justified.

EUTHYNNUS Lütken.

In addition to the superficial characters already named, Kishinouye finds internal features, which differentiate *Katsuwonus* from *Euthynnus*. *Gymnosarda*, with which genus *Euthynnus* has been confounded, proves to have quite a different anatomy and finds its place next to *Sarda*.

220. [347] **Euthynnus yaito** Kishinouye. *Yaito* = Moxa-scar.

One specimen from Choshi (Ishikawa).

This species is frequently taken along the shore in southern Japan. What seems to be the same species, locally known as "Kawakawa," is very abundant in Hawaii, whence it is recorded by Jordan and Jordan as *Euthynnus alleteratus*. But Kishinouye regards it as distinct from that Atlantic species, as well as from *Euthynnus affinis* (Cantor) of the Malayan region. It is the *Thynnus tunnina* of Schlegel, but that name belongs to the European *alleteratus*. The round dark spots, three to five in number, under the pectorals, are characteristic of the *Yaito* at all ages. In a Mexican species, *Euthynnus lineatus*, lately described by Kishinouye from Manzanillo, Mexico, these spots are replaced by short dusky bands.

AUXIS Cuvier.

In this genus, the spinous dorsal is short, as in *Scomber*, but there is little agreement in other regards, and, as Kishinouye justly observes, the two genera belong at opposite ends of the series.

All the species of "Frigate Mackerels" have been provisionally referred to *Auxis thazard* from the South Seas. The Atlantic form is *Auxis rochei* (Risso) or *Auxis bisus* (Rafinesque). As Kishinouye finds two well-marked species in Japan, we cannot identify either with *Auxis thazard* without comparison of specimens.

221. [346] **Auxis tapeinosoma** Bleeker. *Medika, Maru-medika* = Round Medika.

Auxis tapeinosoma BLEEKER, Verh. Bat. Gen., XXVI, 98, tab. 7, fig. 1, 1854. (Nagasaki).

Auxis maru KISHINOUYE, Sui. Gak. Ho., I, 1915, 24, pl. I.

This species is common in the markets southward. It runs in schools. We have examples from Tokyo, Kyoto, Misaki, and Toyama. Kishinouye considers it a species distinct from *A. tapeinosoma*, which is described as otherwise similar, but with nine, instead of eight, dorsal finlets. Gill-rakers 36; D. IX or X–12–8; A. 13+VII. But as Bleeker's type came from Nagasaki it is probably the same.

222. **Auxis hira** Kishinouye. *Hira-medika* = Broad Medika.

This species, not recognized by us, is said to be abundant in southern Japan. The fin-rays are the same as in the preceding species, the gill-rakers 39, the body deeper and more compressed, the depth about equal to length of head.

Family GEMPYLIDÆ.

223. [357] **Promethichthys prometheus** (Cuvier and Valenciennes).

Kuro-shibi-kamasu = Black Tunny Barracuda.

Tokyo market (Jordan). This needs comparison with its Atlantic cognate, originally described from St. Helena.

224. [358] **Ruvettus tydemani** Weber.

Ruvettus pretiosus Jordan, Tanaka, and Snyder, Journ. Coll. Sci. Tokyo, XXXIII, 1913, p. 123, and other authors (not of Cocco).

Ruvettus tydemani Weber, Fische Siboga-Expedition, 1913, p. 401.

Ruvettus pacificus Jordan and Jordan, Mem. Car. Mus., X, 1922, p. 34. (Honolulu).

Weber and Jordan and Jordan, independently noticing that in the Pacific Ocean *Ruvettus* has fewer fin-rays than in the Atlantic, have each given a new name to the Pacific form. Weber's name has priority.

This species has been recorded from Japan, but is not represented in the present collection.

225. [359] **Nealotus tripes** Johnson.

A single specimen of this rare fish was collected by Aoki at Misaki.

Dorsal, XX–3, 15, II; anal I–I, 1, 15+II; scales between origin of dorsal and lateral line, and nine scales between end of spinous dorsal and lateral line.

We have no Atlantic material for comparison.

Family TRICHIURIDÆ.

226. [363] **Trichiurus japonicus** (Temminck and Schlegel).

Tachino-uwo = Sword-fish.

Tokyo market, Toyama, Fukuoka, Noo.

This excellent food-fish is very common in all markets.

The key given by Klunzinger, (Fische d. Rothen Meeres, 1884, 120) is useful in distinguishing species of *Trichiurus*.

Family ISTIOPHORIDÆ.

227. [367] **Tetrapturus mitsukurii** Jordan and Snyder.

Makajiki = True Spear-fish.

Common in the markets, reaching a length of twelve to fifteen feet, or more. Two other species of this genus, *T. mazara* Jordan and Snyder, and *T. angustirostris* Tanaka, have been described from Japan, but in the rush of the market they could not be discriminated.

228. [365] **Istiophorus orientalis** (Temminck and Schlegel).

Bashokaijiki = Banana Spear-fish.

Mr. Manabe presented Dr. Jordan with a young specimen of this species, taken by him at Kobe. It is also represented in the Museum at Yamada. The species is seldom seen in the markets.

Family CARANGIDÆ.

229. [369] **Scomberoides orientalis** (Temminck and Schlegel).

Ike-katsuwo = Pond Victor-fish.

Kagoshima Bay (Wakiya).

Dorsal rays, I–VI–I, 20; anal, II–I, 18 or 19.

230. [371] **Seriola aureovittata** Temminck and Schlegel.

Buri; *Fukuraji* = Plump Aji, or Caranx.

Otaru market (Takayasu); Sapporo market (Majima); Osaka market (Jordan).

231. [371A] **Seriola quinqueradiata** Temminck and Schlegel.

With the preceding and quite as abundant.

Dorsal rays V or VI (the sixth becoming buried in the skin with age)—I, 30 to 33; anal, II–I, 18 to 20; pectoral 17; caudal, 17, of which 15 branched; gill-rakers on lower limb of first arch, 21 to 23. Everywhere common southward in the markets.

232. [372] **Seriola purpurascens** Temminck and Schlegel.
Hiramasu = Broad Salmon; *Aka-buri* = Red Amber-fish.

Tokyo and Osaka markets (Jordan); Toyama (S. Yoshizawa); Noo. Rather common in the markets.

Gill-rakers on lower limb, 13 or 14 and 2 rudiments.

233. [373] **Seriolina intermedia** (Temminck and Schlegel).
Ai-buri = Blue Amber-fish.

This small species, known generically by its rudimentary, tubercle-like gill-rakers, was very abundant one morning in the Nara market, (coming from Kobe) (Jordan) but no specimens were taken at the time, and none were seen afterwards.

Body plump, shorter, and deeper than in *Seriola*. No yellow stripe on side.

234. [375] **Decapterus maruadsi** (Temminck and Schlegel.
Ao-aji = Green Aji; *Maru-aji* = Round Aji.

Toba market (Jordan and Yoshizawa); Fukui (Nonaka); Misaki (Aoki); Kobe market (Jordan); Miyazu. Common.

235. [376] **Decapterus muroadsi** (Temminck and Schlegel).
Muro-aji = Bone-aji.

Tokyo and Osaka markets (Jordan); Toba market (Jordan and Yamamoto); Kagoshima Bay (Wakiya); Toyama (Yoshizawa); Misaki (Aoki). Generally common.

236. [378] **Trachurus japonicus** (Temminck and Schlegel). *Ma-aji* = True Aji.

Misaki (Aoki); Tokyo, Shizuoka, and Kobe markets (Jordan); Kushiro (Tanaka); Tatoku Island (Mikimoto); Kagoshima Bay (Wakiya); Mikawa Bay (M. Ishikawa); Toyama (S. Yoshizawa); Fukui (Nonaka); Miyazu, Noo. Very common in markets.

237. [379] **Trachurops mauritiana** (Quoy and Gaimard). *Me-aji* = Big-eye Aji.

Tokyo and Shizuoka markets (Jordan); Wakanoura (Yoshigawa); Misaki (Aoki).

We have compared Japanese specimens with others from various parts of the world, but are unable to appreciate any differences in proportions. In scale-counts slight average differences are suggested, but these are not sharp enough to warrant the division of the species. We count the scales along the lateral line to caudal base as 87 to 94 in Japan; 87 to 94, Philippine Islands; 86 and 90 in two from the Hawaiian Islands; 88 to 94 in Samoa; 83 to 93 in the region of Panama; 85 to 87 in Jamaica; 84 to 89 in Cuba; 90 in one from Woods Hole, Massachusetts.

The gill-rakers vary from 9 to 11+27 to 30, without apparent geographical correlation. The two isolated anal spines seem to grow relatively longer with age. The name *Selar* must by our rules supersede *Atule* not *Trachurops*.

238. [380] **Carangoides equula** (Temminck and Schlegel). *Hira-aji* = Broad Agi.

Shizuoka and Osaka markets (Jordan); Toba market (Jordan and Yamamoto); Kochi (Wakiya); Mikawa Bay (M. Ishikawa); Misaki (Aoki).

Rather common. Body everywhere suffused with brassy; fins light yellow.

239. [381] **Longirostrum delicatissimum** (Döderlein)[82].
Shima-aji = Striped Aji.

Osaka and Tokyo markets (Jordan).

240. [383] **Caranx bixanthopterus** Rüppell.

This common food-fish of the Middle and Western Pacific, widely known as *Ulua,* was not obtained in 1922, unless represented among the numerous young examples from Misaki, Tokyo, Toba, and Kagoshima. These specimens have been placed in the American Museum to be studied by Mr. John T. Nichols.

The name *Caranx forsteri* Cuvier and Valenciennes, cannot possibly belong to this species. *Caranx melampygus* Cuvier and Valenciennes, wrongly identified with *Caranx stellatus* Quoy and Gaimard, has the same long dorsal and anal fins (D. 23, A. 19), the anterior rays of both fins much elevated and black at tip. But Dr. Wakiya finds a species of this type in Ryūkyū with these lobes proportionately still higher. This species he calls *Caranx melampygus.* The oldest name certainly applicable to the *Ulua* or *Kasumi-aji* is *bixanthopterus,* an appropriate term as the pectoral fins are bright yellow in life.

241. [387] **Alectis ciliaris** (Bloch). *Itohiki-dai* = Silk-thread Porgy.

Tokyo market (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki). Young specimens with long filaments on the fins.

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[82] In this account of the *Carangidæ* we have closely followed the nomenclature of Dr. Wakiya in his paper entitled "The Carangoid Fishes of Japan," recently issued in the Annals of the Carnegie Museum, Vol. XV, pp. 139–292.

Family RACHYCENTRIDÆ.

242. [389] **Rachycentron canadum** (Linnæus). *Suji.*

Osaka market (Jordan). Rare. This form, which is *R. pondicerrianum* of Cuvier and Valenciennes, requires comparison with Atlantic specimens of *R. canadum.*

Family LEIOGNATHIDÆ.

243. [390] **Leiognathus nuchalis** (Temminck and Schlegel).

Hiiragi = Holly-tree.

Mikawa Bay (M. Ishikawa); Tokyo and Shizuoka markets (Jordan); Toba market (Jordan and Yamamoto); Kochi (Wakiya); Fukuoka (Hamada); Fukui (Nonaka). Generally common.

244. [391] **Leiognathus rivulata** (Temminck and Schlegel).

Okihiiragi = Offshore Hiiragi.

Wakanoura (Yamamoto); Kobe market (Jordan); Tatoku Island (Mikimoto); Toyama (Yoshizawa); Misaki (Aoki); Noo.

The greatest depth of the body is contained 2.8 to 3.2 times in the length to caudal fin.

Family CORYPHÆNIDÆ.

245. [394] **Coryphæna hippurus** Linnæus. *Shiira* = Dolphin.

Tokyo market (Jordan); Misaki (Aoki); Fukui. Generally common.

The specimen from Misaki is a young individual, in all essential respects like the type of *Ectenias brunneus* Jordan and Thompson.[83] The other specimens are half-grown individuals, and serve to connect these young specimens definitely with the adult of *Coryphæna.*

Family BRAMIDÆ.

246. [401] **Taractes steindachneri** (Döderlein). *Banzai-uwo* = Hurrah-fish.

Argo steindachneri DÖDERLEIN, Denksch. Akad. Wiss. Wein, XLVII, 1883, p. 242 (named as "n. sp., n. gen." and well figured, but not described); *ibid.*, XLIX, 1884, p. 174 (description and excellent figures).

A fine specimen was secured in the Shizuoka market by Jordan. The species must be very rare in Japan.

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[83] Mem. Car. Mus., VI, 1914, p. 241, pl. XXVII, fig. 3.

Family PAMPIDÆ.

247. [404] **Pampus argenteus** (Euphrasen). *Managatsuwo.*

Yokohama and Kyoto markets (Jordan); Soo-chow, China (Dr. Cora B. Reeves).

Generally common southward. A valued food-fish.

Family STROMATEIDÆ.

248. [406] **Psenopsis anomala** (Temminck and Schlegel). *Ebodai.*

Kagoshima Bay, Kochi (Wakiya); Tokyo market (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Miyazu, Sea of Japan; and Yamada. Seen in Ozaka, Kobe, and Yokohama.

This small species is generally common southward in the markets, and is valued as a table-fish.

Dorsal spines 6, graduated; vertebræ strong, about 12–15 in number; flesh firm, and much as in *Poronotus* or *Palometa*. Ventral fins well developed.

Family CENTROLOPHIDÆ.

Genus OCYCRIUS Jordan and Hubbs, gen. nov.

Type: *Centrolophus japonicus* Döderlein.

This genus is closely related to *Palinurichthys* Bleeker, (*perciformis*) of the eastern coast of the United States, differing in the more elongate body, the longer and much more pointed lobes of the deeply forked caudal, and the lanceolate pectoral. It is also related to the Australian *Hyperoglyphe*, in which genus the dorsal spines are higher, the median highest, the scales smaller and the fins also pointed. Regan unites all these, with others, under the preoccupied name of *Lirus* Lowe, which must be replaced by *Mupus* Cocco.

249. [407] **Ocycrius japonicus** (Döderlein). *Medai* = Big-eye Porgy.

(Plate IX; fig. 4.)

Two specimens from the Tokyo market (Jordan), 29 and 41.5 cm. long to caudal fin.

These specimens agree with Döderlein's account in all respects, except those which might have been produced by the drying out or poor preservation of his type. Such a condition would account for the much larger size of the orbit, the presence of a keel on top of head, the concave contour on front of interorbital space, the greater prominence of the serrations on the margins of the opercular bones, etc., of the type, as compared with our material.

Dorsal rays, VII or VIII, 23 to 26; anal, III, 18. Dorsal spines, very short, subequal, largely concealed in a scaly thick sheath, not graduated into the soft rays. Head evenly gibbous, without a keel above. Eye (not orbit) much shorter than interorbital width, a little shorter than snout, not quite one-fourth length of head. Preopercle, subopercle, and interopercle with weak denticulations. Supplemental maxillary small and indistinct. Gill-rakers long and strong, about 6+16; lateral line becoming straight at tip of pectoral; roof of mouth rounded without evident groove.

Family PEMPHERIDÆ.

Genus CATALUFA Snyder.

Snyder has distinguished a genus *Catalufa*, with the new species, *umbra*, from Japan as the type, and containing also *Pempheris compressus* of Australia, the scales being all strongly ctenoid in these two species, instead of largely smooth, as in most Pempherids. But *Pempheris compressus* is the original type-species of *Pempheris*. The species retained by Snyder in *Pempheris* have been placed by Ogilby (1913) in a new genus, *Liopempheris*. *Catalufa* and *Pempheris* may, however, be regarded as generically distinct, as the lateral line in the type of *Catalufa* is almost straight, whereas in *Pempheris*, as in *Liopempheris*, it is strongly curved.

250. [409 and 412] **Catalufa japonica** (Döderlein). *Agonashi.*

Pempheris japonicus STEINDACHNER and DÖDERLEIN, Beit. Fische Japans, II, 1884, p. 29.

Catalufa umbra SNYDER, Proc. U. S. N. M., XL, 1911, p. 528; XLII, 1912, p. 412, pl. 52, fig. 3.

Two specimens, 77 and 80 mm. to caudal fin, from Toba (Jordan and Yamamoto).

Dorsal rays VI, II; anal rays, III, 35 or 37; scales 14–76–29. Depth of body, 2.2; head, 3.35 in total length to base of caudal. Depth of caudal peduncle, 3.0 or 3.2 in length of head; eye, 2.35; snout, 5.5; upper jaw, 1.9 or 2.0; interorbital space, 3.3 or 3.4; scales on front half of interorbital space imbedded in the fleshy skin, but not absent as described by Döderlein; the "5–6 mehr oder minder stark entwickelte zahnähnliche Dornen" described by Döderlein as developed along the outer mandibular edge near the symphysis are merely a row of upturned spinules on the strongly ctenoid scales of the mandible; other head characters are as described by Döderlein and by Snyder. Origin of dorsal about twice as far from tip of middle caudal rays as from tip of mandible. Highest dorsal spine 1.4 in head; first soft ray (not the fourth as obviously misprinted in Snyder's description) longest, 3.4 or 3.6 in total length to caudal, or 1.1 in length of head; base of dorsal, 4.6 or 5.2 in total length, equal to length of head to posterior margin of eye. Origin of anal equidistant between tip of mandible and base of caudal, or a little nearer the former; the base of the fin exceeding length of head by a distance somewhat greater than orbital length. Ventral inserted barely in advance of vertical from end of pectoral base. Second and longest anal ray a trifle longer than eye; margin of the fin weakly concave anteriorly. Ventral spine about two-thirds the total length of fin, which equals the dorsal base, being contained 4.6 or 5.2 times in total length; pectoral pointed, its length 1.2 in head, or 3.8 in total length. Scales all evenly disposed, of regular size, closely imbricate and strongly ctenoid (except on top of head anteriorly). Lateral line very slightly curved anteriorly, running nearly straight from upper end of gill-opening to end of middle caudal rays, not parallel with the dorsal contour posteriorly; least distance from origin of dorsal to lateral line equal to length of eye.

Color deep brown, with about eleven dark vertical bars about as wide as the lighter interspaces, and very indefinite, except near middle of body. Lobes of dorsal, caudal, and anal broadly marked with black; ventrals blackish posteriorly, puncticulate; pectorals nearly clear.

The excellent description by Steindachner and Döderlein is obviously based on an example of the present species. They err, however, in referring Schlegel's *Pempheris molucca*, which is rather the species here called *sasakii* to the synonymy of *japonicus*. It is this fact which probably led Professor Snyder to rename the present species, and to apply the name *japonicus* to a species of *Liopempheris*. The latter we here provisionally identify as *Liopempheris vanicolensis*.

251. **Liopempheris sasakii** Jordan and Hubbs, sp. nov. (Plate X; fig. 1.)

Pempheris molucca TEMMINCK and SCHLEGEL, Fauna Japonica, Pisces, 1844, p. 85, pl. 44, fig. 3 (not of Cuvier and Valenciennes).

Type, a specimen 97 mm. long to the caudal fin, from Toba (Jordan and Yamamoto) C. M. Cat. Fishes, No. 7861.

This species is not, as Döderlein and others have indicated, synonymous with *Pempheris* (= *Catalufa*) *japonicus*, being referable rather to the genus *Liopempheris* Ogilby (1913). From other species of that genus it differs in the smaller size of the scales, about as numerous as in *Catalufa japonica*.

Dorsal rays, VI, 9; anal, III, 41; scales, 8–74–23. Depth, 2.45 in length; head, 3.6; eye, 2.6; interorbital width, 4.5; width of head, 1.9; snout, 4.35. Interorbital space, snout, and preorbital region entirely scaled, except immediately about eye and nostrils. Lateral line rather strongly curved throughout its length, the highest point of the curve about as distant from the chord of the curve as the lateral line is from the origin of dorsal; lateral line everywhere completely paralleling the dorsal contour. Scales deciduous, cycloid, or very weakly ctenoid where remaining, their exposed faces deeper than long. Origin of dorsal about 2.45 times as distant from tip of caudal as from tip of mandible; sixth dorsal spine longer than snout and eye, contained 1.4 times in head; first and longest soft ray slightly longer than postorbital; base of dorsal a little shorter than distance from tip of mandible to posterior orbital margin; base of anal equal to distance from anal origin to front of head, exceeding length of head by a distance greater than twice diameter of eye; origin of anal about below middle of dorsal base; second and longest anal ray slightly longer than eye; insertion of ventral fin slightly in advance of lower posterior end of pectoral base; ventral spine as long as eye, the soft rays 1.4 times longer, just reaching anal origin; length of pectoral, 1.1 in head.

Color olive-brown, becoming darker on tip of snout, in front of preopercular ridge, on opercle along subopercular margin, on abdomen behind line joining pectoral and ventral bases, just within the anal base, on internal base of pectoral, and about the lateral line near its origin; silvery with black specks below the eye and below and before the pectoral and ventral bases; lateral line an unpigmented streak. Dorsal broadly blackish along front margin and at tip, otherwise pale; caudal light dusky, blackening toward free edge; anal black near front, but throughout most of its length whitish proximally, abruptly blackish on distal half; paired fins clear, except for black punctations at their bases.

This species is named for Madoka Sasaki, Professor of Marine Zoölogy at the Imperial University of the Hokkaido at Sapporo. *Liopempheris nyctereutes* (Jordan and Evermann) from Formosa seems closely allied to *L. sasakii.*

252. [Extraterr.] **Liopempheris vanicolensis** Cuvier and Valenciennes.

Pempheris japonicus Snyder, Proc. U. S. N. M., XLII, 1922, p. 497 (Okinawa) (not of Döderlein).

The specimens of *Pempheris* recorded as *P. japonicus* from Okinawa (Ryūkyū) by Snyder, were certainly incorrectly determined. The original *P. japonicus* is the species subsequently described by Snyder as *Catalufa umbra.* The Okinawa specimens, which we have re-examined, are close to *P. vanicolensis,* and are probably identical with that species, of which we have three specimens from the Philippines and Samoa. These have 43 to 45 anal soft rays (Günther counted 38 to 40, Bleeker 39 to 45); the two from Okinawa have only 36 rays. They have about 9 or 11–49 or 51–12 scales, but the scale-count is here of little value, except along the lateral line, because the normally very large scales are replaced in irregular and inconstant patches by very much smaller scales; thus one specimen has three, another eight rows between the lateral line and the median dorsal row on the caudal peduncle, and the number varies on the two sides of the same fish; sometimes as many as six or eight small scales will replace a single large one on the lower side. There is no spot on the base of the pectoral fin, but the dorsal and anal fins were probably originally black; the fin-membrane is here lost, however, and the rays more or less broken, so that the fins appear nearly clear. In general appearance these specimens from Okinawa are like those of *L. vanicolensis.*

Family APOGONIDÆ.

253. [413] **Apogonichthys carinatus** (Cuvier and Valenciennes).
Mato-ishimochi = Target Rice-fish.

Wakanoura (Yamamoto); Toba (Jordan and Yamamoto); Kochi (Wakiya); Misaki (Aoki).

Young, 5 to 6 cm. long, have the body crossed mesially by about eight dark shades of varying width, somewhat expanded toward their truncated upper and lower ends. Specimens 7 to 8 cm. long still show these bars, but less distinctly. In the adults they have vanished completely.

254. [414] **Apogon lineatus** Temminck and Schlegel. *Mochiuwo* = Rice-fish.

Wakanoura (Yamamoto); Toba (Jordan and Yamamoto); Kobe market (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Toyama, Fukui, and Noo, all on the Sea of Japan. Dr. Cora B. Reeves has sent specimens from Soo-chow, China, to the University of Michigan.

Everywhere common southward. A little shore-fish.

255. [415] **Apogon niger** Döderlein. *Kuro-ishimochi* = Black-rock Rice-fish.

We have one example of this species, collected by Aoki at Misaki. It shows no definite markings on the body.

256. [420] **Apogon semilineatus** Temminck and Schlegel.

Wakanoura (Yamamoto); Misaki (Aoki).

Coloration typical.

257. [422] **Apogon kiensis** Jordan and Snyder.

A specimen from Misaki (Aoki) agrees well with the types. The upper band is continued backward faintly to the caudal fin, and there is an indistinct dusky line both above and below the main black band, and finally another, somewhat wider, running straight backward from the upper margin of eye to below the interval between dorsal fins. Traces of these less distinct lines remain in the types.

258. [425] **Synagrops japonica** (Döderlein). *Sumikui-uwo* = Ink-fish.

A single specimen was obtained by Aoki at Misaki.

Family SCOMBROPIDÆ.

259. [426 and 427] **Scombrops boöps** (Houttuyn). *Mutsu.*

?*Telescopias gilberti* Jordan and Snyder, Proc. U. S. N. M., XXIII, 1901, p. 909, pl. 45.

Yokohama, Shizuoka, Osaka, and Tokyo markets (Jordan); Toba (Jordan and Yamamoto); Misaki (Aoki). The small red form (*boöps*) is generally common; the large black form (*gilberti*) is distinctly rare.

The only sharply distinctive feature accredited to *Telescopias gilberti* is the number of anal spines, two, instead of three, as in *Scombrops boöps*. But the type specimen has three anal spines, the first indeed very small, but evident. Differences in proportions and in scale-counts do not seem to hold. The color is pale dull red in the ordinary *Mutsu* (*boöps*) and perhaps changes to black with age (*gilberti*).

Depth of body 3.6 to 4.3; orbit, 3.0 to 3.5 (slightly decreasing in relative size with age); depth of caudal peduncle, 3.2 to 3.6. Scales 51 to 65 along lateral line, 17 to 21 in transverse series; developed gill-rakers, 1 to 4 and 11 to 14.

We have a young example from Misaki; a series of specimens corresponding with *J. boöps* from the same place and from Yokohama, Tokyo, and Toba markets; one intermediate in size and color between *boöps* and "*gilberti*," from the Shizuoka market, and a large adult, like the type of *gilberti*, from the Yokohama market, where several others were seen. In spite of this evidence, we are not yet fully convinced that the rare *gilberti* is the adult of the common *boöps*.

Family ACROPOMIDÆ.

260. [430] **Acropoma japonicum** Günther. *Dabo-mutsu.*

Two specimens were obtained by Yamamoto at Wakanoura.

Family KUHLIIDÆ.

261. [Extraterr.] **Kuhlia rupestris** (Lacépède). *Mikyu.*

We have a specimen of this species from Chatan, Ryūkyū, collected by H. Kuroiwa.

Dorsal, X, 11; anal, III, 10; scales, 5.5–39–8.5; gill-rakers, 7 and 18. Depth, 2.7; longest dorsal spine a little shorter than longest soft ray, and not quite one-half length of head.

Family PRIACANTHIDÆ.

262. [433] **Priacanthus macracanthus** Cuvier and Valenciennes.

Beni-mebaru = Red Pop-eye; *Kinme* = Gold-eye.

Osaka market (Jordan); Mikawa Bay (M. Ishikawa); Fukui (Nonaka); Miyazu. Six specimens in all.

Dorsal rays, X, 12 (one specimen) or 13 (five specimens); anal rays, III, 14 (all cases). Depth of body decreasing with age, but greater than length of head in all our specimens (depth 2.6 in a specimen 117 mm. long to caudal; 2.8 to 2.9 in four 130 to 142 mm. long; 3.3 in adult). Preopercular spine reaching to gill-opening in one young, farther in all other specimens. Both dorsals and ventral blotched with dark, especially in the young; anal largely clear.

263. [434] **Priacanthus meeki** Jenkins. *Hoseki-Kinme* = Gem Gold-eye.

Tatoku Island (Mikimoto); Misaki (Aoki). Two young specimens, 94 and 99 mm.

Dorsal rays X, 13 or 14; anal, III, 15 (both cases). Depth of body greater than length of head, 2.6 in standard length. Preopercular spine not reaching gill-opening. Vertical fins dusky, becoming black anteriorly; ventrals largely black with some lighter markings.

This species seems identical with *Priacanthus meeki,* the common form in Hawaii. In *P. hamruhr* of the Red Sea and East Indies the body is said to be more elongate, the depth 3. to 3.5 in length.

264. [435] **Priacanthus japonicus** Cuvier and Valenciennes.

Chikamo-Kinme = Near-sighted Gold-eye.

Tokyo and Yokohama markets (Jordan); Kochi (Wakiya); Toyama (Yoshizawa); Miyazu, Misaki (Aoki).

265. [436] **Pseudopriacanthus niphonius** (Cuvier and Valenciennes).
Kuruma-dai = Wheel-porgy.

Tokyo market (Jordan); Kochi (Wakiya); Misaki (Aoki).

One of the Misaki specimens is a young one, matching Schlegel's figure (pl. 7a, fig. 2).

Family OLIGORIDÆ.

266. [437] **Malakichthys griseus** Döderlein. *Omehata* = Big-eyed Bass.

We have nine specimens of this peculiar bass-like fish; eight collected by Mr. Yōjirō Wakiya at Kagoshima; and one by Dr. Jordan in the Shizuoka fish-market. There seems to be no reason to doubt the identity of *Satsuma macrops* Smith and Pope with this species.

267. [437A] **Malakichthys wakiyæ** Jordan and Hubbs, sp. nov.
(Plate X; fig. 2.)

Type a specimen 119 mm. long to the caudal fin, collected by Wakiya in Kagoshima Bay; C. M. Cat. Fishes, No. 7863. Six paratypes were obtained at the same place.

This sharply marked species differs from *M. griseus,* hitherto the only one known, in many ways. The anal fin has 9, or rarely 10, soft rays, instead of only 7, the base of this fin is about half longer, instead of shorter than, the length of the anal spine. All of the fins are smaller; the soft portion of both dorsal and anal fins are longer, instead of shorter than high; the pectoral reaches not quite so far as, or barely to, the vertical from front of anal (in one specimen to above second anal spine), instead of to above first soft ray of anal (in one specimen only to above second spine); the ventral does not nearly reach to the vent, only one-half to two-thirds the distance to the origin of the anal, instead of nearly to the vent, and more than two-thirds the distance to the anal. The head is shorter and much narrower; the eye smaller; head 2.6 to 2.75 (instead of 2.35 to 2.6), much less than, instead of about half as wide as long; eye shorter than, instead of as long as, postorbital, 2.8 to 3.0 (not 2.5 to 2.7) in head. The vomerine teeth form a distinctly Y-shaped figure, instead of a triangle with moderately concave sides. The scales are slightly smaller. Dorsal rays, IX, I, 10; anal, III, 9 (10 in one specimen); pectoral, 13; ventral, I, 5; caudal, 17 (15 branched); scales, 5 to 6–47 to 49–13 or 14 (5 or 6–42 to 45–12 to 14 in *M. griseus*); gill-rakers 22 to 24 below angle on first arch; branchiostegals, 7. Body rather angular, deepest below origin of dorsal (depth 2.6 to 2.7). Dorsal contour before this point gently sigmoid, being concave above eye behind front of dorsal, gently curved to caudal peduncle; ventral contour flattish medially, but ascending rather abruptly on mandible and along anal base. Head, as viewed from above, much thinner and less wedge-shaped than in *M. griseus*. Interorbital slightly convex, cavernous, about two-thirds as wide as eye (scarcely more than half eye in *M. griseus*); border of orbit and preopercular ridge sharp (in preserved specimens); preopercular margin denticulate on lower border and about the produced rounded angle; opercle ending in two sharp points, the lower the longer; opercular membrane wide, extending well behind pectoral base. Mandible strongly projecting, with two sharp spines at tip; maxillary with a long narrow supplementary bone above a strong sharp ridge, which fits against the edge of the narrow suborbital. Teeth minute, granular, except in outer row of jaw, in rather wide bands in jaws, in a Y-shaped group on the vomer (the base of the Y pointing forward), and in a very narrow band running into a single series posteriorly on the sharp elevated ridge of the palatine; none on the tongue. Scales rather firm, about twice as deep as long, the basal margin straight, scalloped between the ends of the strong radii; focus near apical margin; circuli only moderately angulated between dorsal and lateral fields, running into the lateral margin at an angle of about 45 degrees; no circuli, radii, or ctenii on the narrow apical field; the apical margin sharply denticulate. Head almost completely scaled.

Body light olive-brown above, becoming darker on the snout; the sides and lower surfaces bright silvery. Fins with some dusky color, the spinous dorsal becoming black at margin; a black spot on axil of pectoral, more distinct than in *M. griseus*.

268. [439] **Lateolabrax japonicus** (Cuvier and Valenciennes). *Suzuki* = Sea-bass.

Sapporo market (Majima); Tokyo and Kobe markets (Jordan); Kagoshima Bay (Wakiya); Mikawa Bay (Ishikawa); Miyazu, Fukuoka (Hamada); Lake Kasumigaura (Hattori). A very common and valued food-fish throughout Japan.

Family NIPHONIDÆ.

269. [440] **Niphon spinosus** Cuvier and Valenciennes. *Ana* = Sea-bass.

Tokyo market (Jordan); Toyama (Yoshizawa); Misaki (Aoki); Miyazu, Fukui. An uncommon species, reaching a considerable size.

Family EPINEPHELIDÆ.

270. [441] **Bryttosus kawamebari** (Temminck and Schlegel).

Kawa-mebaru = River Pop-eye or "Rock-cod."

Tsuyama, near Okayama (Kawamura); Kumamoto (Wakiya); Himeji (Abe); Fukuoka (Hamada).

The preopercle, subopercle, interopercle, and the large bony scapular scale, all have their margins denticulate, but covered with skin. We count only 37 scales in the lateral line to caudal base. It is a river-fish, bearing a strong resemblance to the American *Centrarchidæ* or Sun-fishes.

271. [Extraterr.] **Siniperca chua-tsi** Basilewsky.

A half-grown specimen of this common River-bass of China has been sent by Dr. Cora B. Reeves to the Museum of Zoölogy, University of Michigan. It agrees well with Boulenger's description.

272. [Extraterr.] **Coreoperca herzi** Herzenstein.

Wakiya has sent a specimen of this River-bass from the Ping-yang River in Korea. Jordan and Metz erroneously indicated *Coreoperca whiteheadi* Boulenger[84] as a synonym of *C. herzi.*[85]

Dorsal rays, XIV, 13; anal, III, 8.

273. [450] **Epinephelus craspedurus** Jordan and Richardson.

A young specimen taken in the Toba market (Jordan and Yamamoto) agrees well with the description of the type, except that the caudal is truncate, not slightly emarginate. Otherwise known only from Kagoshima.

274. [455] **Epinephelus epistictus** (Temminck and Schlegel).

Komon-hata = Backward Bass.

One young: Wakanoura (Yamamoto).

275. [456] **Epinephelus morrhua** (Cuvier and Valenciennes). *Iyagobata.*

Toba (Jordan and Yamamoto).

We follow Boulenger in our identification of this species, and consider *E. doderleini* Franz (1910) as probably not a distinct species; we have, however, no material of that type.

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[84] Proc. Zoöl. Soc. London, 1889, p. 960, pl. 68. Boulenger here gives a good re-description of *C. herzi.*

[85] Herzenstein, Ann. Mus. Zool. Acad. Imp. Sci. St. Petersb., 1896, p. 11.

In the adult the bands of the young become replaced by double rows of spots. The disruption of the bands takes place in a regular manner and sequence. The pigment becomes concentrated toward the edges of the bands, so as to form two streaks, which later break up into lines of spots. The lower posterior part of the body is first affected, the progress of disruption being toward the nape, where the bars still remain intact in our adult specimen.

276. [458] **Epinephelus moara** (Temminck and Schlegel). *Moara* = Sea-weed Bass.

Toba market (Jordan and Yamamoto); Mikawa (M. Ishikawa).

277. [459] **Epinephelus awoara** (Temminck and Schlegel). *Aoara* = Green Bass.

Mikawa Bay, Miyazu, Fukui.

278. [460] **Epinephelus septemfasciatus** (Thunberg). *Mahata* = True Hata, or bass.

Tokyo market (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Fukui (Nonaka); Misaki (Aoki); Miyazu.

279. [461] **Epinephelus tsirimenara** (Temminck and Schlegel).
Akahata = Red Bass.

Toba (Jordan and Yamamoto).

280. [476] **Doderleinia berycoides** (Hilgendorf). *Aka-mutsu* = Red Mutsu.

Shizuoka (Jordan); Toyama (S. Yoshizawa); Miyazu; Noo near Niigata. Not common, its color a brilliant brick-red.

Family SERRANIDÆ.[86]

281. [464] **Chelidoperca hirundinacea** (Cuvier and Valenciennes).
Hime-ko-dai = Little Princess Porgy.

Kagoshima, Kochi (Wakiya); Misaki (Aoki).

282. [465] **Sayonara satsumæ** Jordan and Seale. *Sakura-dai* = Cherry Porgy.

Kochi (Wakiya).

283. [466] **Caprodon schlegeli** (Günther). *Aka-isagi* = Red Isagi, or Croaker.

Kyoto market (Jordan); Toba (Jordan and Yamamoto).

Eye golden-yellow; body mostly scarlet.

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[86] The Serranoid genus, *Rhyacanthias* Jordan (*carlsmithi*) (Proc. U. S. N. M., 1925 lately described from Hawaii, seems inseparable from *Symphyanodon* Bleeker (*typus*), Arch. Neerl. XII, 61, 1878. The minute teeth on the palate were overlooked by Bleeker, who placed the genus near *Pomadasys*.

Family LUTIANIDÆ.

284. [481] **Lutianus russelli** (Bleeker). *Kuro-hoshi-fuedai* = Black-star Porgy.

Kochi, Shikoku (Wakiya).

285. [483] **Lutianus vaigensis** (Quoy and Gaimard).
Okifuyedai = Off-shore Air-bladder Porgy.

Kagoshima Bay (Wakiya).

286. [484] **Lutianus vitta** (Quoy and Gaimard).
Kinseisaki = Symmetrical Isaki.

Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa); Fukui (Nonaka); Miyazu. Not rare.

287. [487] **Ulaula sieboldii** (Bleeker).
Yoko-suji-fuyedai = Red Air-bladder Porgy.

A fine specimen 23 cm. long to the caudal fin, was taken at Toba. (Jordan and Yamamoto).

Head, 3.2; depth, 3.5; eye, 5.8; dorsal, X, 11; anal, III, 8; scales, 8.5–70–16; gill-rakers, 2.4 in eye; fifth dorsal spine longest, 2.35 in head; third anal spine, 3.5; pectoral fin, 1.07.

The presence of a patch of teeth on the tongue and the slight development of canines warrant the recognition of *Ulaula*[86] as of generic rank.

Family THERAPONIDÆ.

288. [490] **Therapon oxyrhynchus** Temminck and Schlegel.
Shima-isagi = Striped Croaker.

Kachi River at Nagoya, with fresh-water fishes (Jordan); Toba market (Jordan and Yamamoto); Mikawa Bay (Ishikawa); Miyazu, Lake Mikata near Fukui. Common.

The young of this species live in the bays and estuaries, ascending streams. These, when about 5 or 6 cm. long, differ widely from the adult, described by Jordan and Thompson.[87]

The head is longer (2.7 to 2.8 in length to caudal), and the depth of the body greater (2.7 to 2.9). The coloration is markedly different from that of the adult, which is well shown in Schlegel's plate (pl. 6, fig. 3). The secondary bands are not developed, only the primary four being evident. A tendency toward a vertical, as well as a longitudinal, pattern is brought out by a slight intensification of the ground-color in line with dilated and especially darkened portions of the stripes. The spinous dorsal is marked with blackish mottlings on base and with large distal blotches on the membranes. The soft dorsal and caudal fins are longitudinally streaked with black, but pale-bordered. Similar specimens were recorded from Swatow, China, by Rutter.[88] Other material from Japan, both in the present collection and in the Stanford Museum, fully connects these young with the adult. They show little approach toward the very small fish described and figured by Franz[89] as the young of this species.

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[86] Jordan and Thompson, Proc. U. S. N. M., XXXIX, 1911, p. 460; Jordan and Jordan, Mem. Car. Mus., X, 1922, pp. 49, 50.

[87] Proc. U. S. N. M., XLI, 1912, p. 538.

289. [491] **Therapon servus** (Bloch). *Yagati-isagi.*

Kachi River at Nagoya, Kobe market (Jordan); Mikawa Bay (M. Ishikawa).

The young of this fish, as those of the last, enter fresh water and associate with Brook-gobies and Minnows. In the young, 5 to 10 cm. long, the form and color are about as in the adult, but the upper band is not broken longitudinally, but, on the contrary, twice vertically by the lighter ground-color.

Family BANJOSIDÆ.

290. [492] **Banjos banjos** (Richardson). *Banzai-dai* = Hurrah-porgy.

Misaki (Aoki). A rare and curious fish.

Family POMADASIDÆ.

291. [493] **Parapristipoma trilineatum** (Thunberg). *Isagi,* or *Isaki.*

Mikawa Bay (M. Ishikawa); Toyama (S. Yoshizawa); Tokyo and Kobe markets (Jordan); Wakanoura (Yamamoto). Common southward.

292. [494] **Plectorhynchus pictus** (Thunberg). *Korodai* = Elder Porgy.

Wakanoura (Yamamoto); Kobe market (Jordan).

293. [495] **Plectorhynchus cinctus** (Temminck and Schlegel). *Kosho-dai.*

Wakanoura (Yamamoto); Toba (Jordan and Yamamoto); Toyama (S. Yoshizawa); Fukui (Nonaka); Misaki (Aoki).

Dorsal rays, XII, 16 to 18; anal, III, 8.

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[88] Proc. Acad. Nat. Sci. Phila., 1897, p. 75.

[89] Abh. Bayer. Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 46, pl. 5, fig. 31.

294. [496] **Hapalogenys mucronatus** (Eydoux and Souleyet).
Higedai = Bearded Porgy.

Osaka market (Jordan).

295. [497] **Hapalogenys nigripinnis** (Temminck and Schlegel).
Letodai = Channel porgy.

Toba (Jordan and Yamamoto); Kochi (Wakiya); Soo-chow, China (sent by Dr. Cora B. Reeves to University of Michigan).

The specimen from Kochi, corresponds with the descriptions of *H. kishinouyei*, which seems to be the young of *H. nigripinnis*.

296. [498] **Scolopsis inermis** (Temminck and Schlegel). *Tamagashira*.

Toba (Jordan and Yamamoto).

Family CÆSIONIDÆ.

Genus Cæsio Lacépède.

297. **Cæsio lunaris** Ehrenberg.

Three specimens of this species, taken by Wakiya at Kagoshima, constitute the first record of the species from Japan proper.

298. **Cæsio cærulaureus** (Lacépède). Hist. Nat. Poiss. III, 1802, p. 85.

A specimen from Kagoshima (Wakiya) is the first to be recorded from Japan.

299. **Cæsio chrysozonus** Kuhl and Van Hasselt.

Twelve examples of this species, which was originally described from the Moluccas, were taken by Wakiya at Kagoshima. The two largest specimens are especially deep, the greatest depth being contained thirty-five times in length to caudal fin. All three of these handsome tropical fishes correspond well with current descriptions.

Family LABRACOGLOSSIDÆ.

It is obvious that *Labracoglossa* has no affinity with the stromateid fishes, with which it has been aligned. It has lately been made the type of a distinct family, with which certain New Zealand genera have been associated.[90] It seems to us that *Labracoglossa* is as near to *Cæsio* as to any other genus.

300. [408] **Labracoglossa argentiventris** Peters. *Takabe*.

Ten specimens, Misaki (Aoki).

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[90] Jordan, Stanford Univ. Publ. (Biol.) 3, 1923, p. 203.

Family DENTICIDÆ.

301. [499] **Euthyopteroma virgatum** (Houttuyn). *Itogoro* = Thread; Adventurer.

Osaka and Kobe markets (Jordan); Mikawa Bay, Fukui, Wakanoura, Miyazu. A beautifully colored fish, generally common southward.

302. [500] **Euthyopteroma bathybium** (Snyder). *Soko-itoyori.*

Kagoshima Bay (Wakiya). Two specimens, one young, with a very large eye (3 in head).

Family SPARIDÆ.

303. [503] **Sparus latus** Houttuyn. *Kuro-dai* = Black Porgy.

Bay of Mikawa (M. Ishikawa).

Scales 5–45–11; depth of body, 2.55; length of longest spine 1.95 in head; second anal spine greatly strengthened and elongate, 1.6 in head; membranes of lower fins largely black medially; streaks on scale-rows obscure; vertical bars obsolete.

We identify our specimens of this genus with considerable doubt. The characters given[91] to separate *S. latus* from *S. macrocephalus* (*S. swinhonis*) do not hold well.

304. [504] **Sparus macrocephalus** Basilewsky. *Morokoshidai* = Minnowlord-tai

Chrysophrys swinhonis Günther, Ann. Mag. Nat. Hist. (4) XIII, 1874, p. 155.

Tokyo and Shizuoka markets (Jordan); Toba market (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Toyama (S. Yoshizawa); Misaki (Aoki); Miyazu, Fukui. Generally common southward. As a food-fish inferior to the Red Tai (*Pagrosomus*).

Scales 6 to 9–48 to 56–14 to 16. Depth of body, 2.4 to 2.6; highest dorsal spine (third or fourth) 2.1 to 2.5 in head; second anal spine, when depressed, reaching to about opposite the middle of the last anal ray, and contained 1.95 to 2.15 times in the head. A dark spot at origin of lateral line; well marked olive streaks along the rows of scales, including those on cheeks; body with several rather narrow cross-bars; lower fins blackish. Dorsal rays, XI, 10 or 11; anal, III, 8.

305. [505] **Lethrinus hæmatopterus** Temminck and Schlegel. *Fuefuki-dai.*

Kagoshima Bay (Wakiya); Miyazu, Sea of Japan.

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[91] See Jordan and Thompson, Proc. U. S. N. M., XLI, 1912, pp. 581–588.

306. [506] **Lethrinus nematacanthus** Bleeker.

Toba market (Jordan and Yamamoto).

307. [508] **Pagrosomus major** (Temminck and Schlegel).

Tai, Akadai = Red Tai, or Porgy.

Kobe market (Jordan); Mikawa Bay (W. Ishikawa); Misaki (Aoki); Miyazu. Common throughout Japan; the most valued food-fish of the Empire, favored by the Fish-God, Ebisu.

In this species the four scale-rows adjoining the lateral line above run parallel with it, whereas the rows between these four and the dorsal fin extend obliquely upward and backward. In the other Japanese sparids all of the scale-rows above the lateral line are parallel with it.

In life the Red Tai has over the eye a spot of the most intense blue, which fades at death. The round light blue spots on the body fade with age and with exposure.

308. [509] **Taius tumifrons** (Temminck and Schlegel). *Kindai* = Golden Tai.

Tokyo and Kobe markets (Jordan); Kagoshima Bay (Wakiya); Misaki (Aoki); Toyama (S. Yoshizawa); Miyazu, Noo.

In life this species is pale red, largely washed with golden; whole front and snout yellow; upper lip mostly yellow; three large diffuse round yellow spots on side of back, fading in death. It is now taken in great numbers in trawl-nets in rather deep water.

309. [510] **Evynnis cardinalis** (Temminck and Schlegel). *Kodai* = Little Tai.

Tokyo market (Jordan); Toba market (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Toyama (S. Yoshizawa); Miyazu.

Our specimens vary widely in the form of the body, the degree of elongation of the dorsal spines, and the development of vomerine teeth, but we are unable to refer them to more than one species. For this reason we doubt the validity of *Parargyrops edita* Tanaka.[92] The species is unique among Sparoid fishes in having a few large bluntish teeth on the vomer. It is common southward and valued as food.

Family GIRELLIDÆ.

310. [511] **Girella punctata** Gray. *Mezina.*

Toba market (Jordan and Yamamoto); Misaki (Aoki).

Dorsal, XV, 13 or 14; anal, III, 12; scales, 53; a dark spot on each scale.

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[92] Fig. Desc. Fishes Jap., 24, 1916, p. 425, pl. 116, fig. 342; pl. 117, fig. 343.

Family KYPHOSIDÆ.

311. [514] **Kyphosus cinerascens** (Forskål). *Tenjiku-isagi* = Indian Croaker; *Kuroisagi* = Black Croaker.

Family GERRIDÆ.

312. [516] **Gerres erythrourus** (Bloch).

Kagôshima Bay (Wakiya).

As the original type of *Gerres* Cuvier, as published in advance by Quoy and Gaimard, was a *Xystœma*, the name *Gerres* must be retained here.

Family SCIAENIDÆ.

Genus Nibea Jordan and Thompson.

We now regard *Sciæna aquila* (Lacépède) as the legitimate type of the genus *Sciæna* Linnæus, as this species was the original form included in the confused synonymy of "*Sciæna umbra*" Linnæus, as first shown by Cuvier. The name *Sciæna* accordingly is restored to the Mediterranean species, called *Pseudosciæna* by Bleeker and earlier *Argyrosomus* by De la Pylaie. *Sciæna umbra* (L.) Cuvier is characterized by the obsolescence of preopercular spines, and of the slits and pores above the mouth, conspicuous in most of the species of this group; teeth in bands, the outer enlarged in both jaws.

The characters of the genera allied to *Sciæna* are singularly elusive, each one being subject to degrees of development. The form of the mouth, the dentition, the armature of the preopercle, the size of the second anal spine, the scaling of the fins indicate groups, which are more or less natural, but which are as yet imperfectly separated. For the present we may refer the Japanese species to the genus *Nibea* Jordan and Thompson (type, *Sciæna mitsukurii*). *Nibea* has the teeth in narrow bands, the outer row above and the inner below somewhat enlarged; gill-rakers moderate; preopercle with some stiff serræ, usually soft; dorsal fin scaleless, with a sheath at base; dorsal fins somewhat connected.

The related genus *Bola* Buchanan (type *Sciæna coitor*) seems to differ mainly in having the soft dorsal covered with small scales, the preopercle usually without bony serræ; gill-rakers relatively short.

Johnius Bloch (type, *J. carutta*) has the lower teeth in a villiform band, none of them enlarged; soft dorsal fin scaly; anal spine small.

313. [518] **Nibea mitsukurii** (Jordan and Snyder). *Guchi* = Big Mouth.

Toba (Jordan and Yamamoto); Shizuoka (Jordan); Choshi (Ishikawa).

Very common in Suruga Bay, where it is much used in making *Kamoboku*.

Dorsal rays, IX or X–I, 29 to 31; anal, II, 7, (rarely III, 8); developed gill-rakers on lower limb, 12 to 15; rows of spots continuous above lateral line, becoming straight below middle of soft dorsal fin.

314. **Nibea albiflora**[93] (Richardson).

On comparison of material we find that the characters supposed to distinguish *Nibea mitsukurii* from the Chinese *Nibea albiflora* hold. Of the latter we have one specimen from Fukuoka (Hamada). This province is on the west coast of Kyūsyū, while the known localities for *mitsukurii* are all on the east coast of Hondo, the species being especially abundant about Shisuoka.

Dorsal rays, X–I, 28; anal, II, 7; only 10 well developed gill-rakers on lower limb; rows of spots not continuous above lateral line, becoming straight only behind dorsal fin and in a strip along lateral line extending forward to below middle of soft dorsal fin.

315. [520] **Nibea schlegeli** (Bleeker). *Ishimochi* = Rock Rice-fish.

Shizuoka, Osaka, Tokyo and, Kobe markets (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Fukuoka (Hamada); Fukui, Shizuoka (Jordan); Miyazu. Common southward, largely used for *Kamoboku.*

Dorsal rays, X–I, 24 to 27. Anal spine sometimes a little longer than the eye. Black blotch on opercle and shoulder usually distinct.

316. [521] **Nibea nibe** (Jordan and Thompson). *Hama-onibe* = Great Beach-Nibe.

Osaka market (Jordan); Mikawa Bay (M. Ishikawa).

The softness of the flesh and the protrusion of the stomach into the mouth in one of our Osaka specimens indicates that this species descends to considerable depths.

Dorsal rays, X–I, 30 to 32; anal, II, 7 or 8. The preopercular spines are moderately enlarged at angle. The scale-rows are marked by dark streaks, less definite, but arranged much as in *Nibea albiflora,* the streaks becoming horizontal only behind the dorsal base. The second anal spine may be nearly as long as the eye.

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[93] See Jordan and Thompson, Proc. U. S. N. M., XXXIX, 1911, pp. 246–252, figs. 1–2.

317. [522] **Nibea japonica** (Temminck and Schlegel). *Nibe*; *Onibe* = Great Nibe.

Tokyo and Shizuoka markets (Jordan).

This species, described in detail by Jordan and Metz from Fusan in Korea, reaches a much larger size than the others, three to four feet in length. It is also distinguished by the loose scales and generally ragged appearance, as compared with the neatness of the others.

Teeth irregular, mostly in one row, some in each jaw irregularly enlarged; no true canines. Small specimens are long and slender, suggesting *Cynoscion* in form and aspect, the scales more even than in the adult. Caudal long, on a long peduncle, irregularly lanceolate, the lower lobe much longer; pectoral fin long. General color gray; mouth orange within; dorsal, caudal, and pectoral black-edged. In this species the large air-bladder is used in making the jelly-isinglass, known as *Nibe.*

Genus OTHONIAS Jordan and Thompson.

This group is technically close to *Bola,* having, as in *Bola,* the soft dorsal scaly, but it differs in several important characters. It definitely approaches *Collichthys* in the large size and obliquity of the mouth, the dentition, the development of sensory cavities, and in the width and convexity of the head. It also resembles that genus in the presence of silvery glandular organs in the skin of the ventral surface, one under each scale; these are possibly light-organs (photophores). The soft dorsal, anal, and caudal fins are closely covered with small scales.

318. [522] **Othonias undovittatus** (Jordan and Seale).

Pseudosciæna undovittata JORDAN and Seale, Proc. Davenport Acad. Sci., X, 1905, p. 11, pl. 6 (Hong Kong).

Sciæna manchurica JORDAN and THOMPSON, Proc. U. S. N. M., XXXIX, 1911, p. 255, fig. 3 (Port Arthur).—JORDAN and METZ, Ann. Car. Mus., VI, 1913, p. 38, fig. 28 (after Jordan and Thompson).

We have compared the type of *Pseudosciæna undovittata,* paratypes of *Sciæna manchurica,* and a specimen obtained in the Osaka market (Jordan), and find them all specifically identical. The type of *S. undovittata* has nine soft rays in the anal fin, not eight, as described. The species is new to Japan. The Osaka specimen has IX–I–33 dorsal rays; II, 10 anal rays; 9+16 gill-rakers.

Family EMMELICHTHYIDÆ.

319. [523] **Erythrocles schlegeli** (Richardson). *Chibiki* = Red Coat.

Toba market (Jordan and Yamamoto).

This species should be accredited to Richardson, not to Bleeker. The name *Erythrichthys* is preoccupied in the *Characinidæ*.

Family OPLEGNATHIDÆ.

320. [524] **Oplegnathus fasciata** (Temminck and Schlegel). *Ishidai* = Rock Tai.

Toba (Jordan and Yamamoto); Tatoku Island (Mikimoto); Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa); Miyazu, Misaki (Aoki).

Our material ranges from young to adult, and illustrates the changes in growth figured by Schlegel; the dark bands, so conspicuous in the young, fading with age.

321. [525] **Oplegnathus punctata** (Temminck and Schlegel).
Ishigaki-dai = Rock-imp Tai.

Kobe market (Jordan); Mikawa Bay (Ishikawa); Misaki (Aoki); Toyama (Yoshizawa); Miyazu. Generally common southward, more so than the preceding.

Family HISTIOPTERIDÆ.

322. [527] **Histiopterus typus** Temminck and Schlegel. *Kawabisha.*

Misaki (Aoki). A rare species.

Family MULLIDÆ.

323. [529] **Upeneoides bensasi** (Temminck and Schlegel).
Beni-sashi = Red Surmullet.

Shizuoka and Kobe markets (Jordan); Wakanoura (Yamamoto); Toba market (Jordan and Yamamoto); Tatoku Island (Mikimoto); Kagoshima (Wakiya); Mikawa Bay (Ishikawa); Toyama (Yoshizawa); Misaki (Aoki); Fukui (Nonaka); Noo, Miyazu. Generally common.

324. [530A] **Upeneoides vittatus** (Forskål).

Two examples of this East Indian Surmullet were obtained by Wakiya at Kagoshima Bay, the first to be recorded from Japan proper.

325. [537] **Upeneoides tragula** (Richardson). *Yome-himeje* = Bride Surmullet.

Toba (Jordan and Yamamoto); Kagoshima (Wakiya).

326. [531] **Mulloides japonicus** (Houttuyn). *Aka-himeji* = Red Surmullet.

Kagoshima (Wakiya).

The main dorsal spines are seven in number, as described by earlier authors, and in all the material we have available, not eight, as reported by Snyder.[94] An additional spine in front of these is minute when present, but often absent.

Our specimens preserve much of their original color. The general tone is a bright yellow, becoming pink along the middle of the sides, above the large blackish opercular blotch, along the anterior free margin of the subopercle (which otherwise, like the interopercle, is silvery) and on the postorbital region.

327. [535] **Upeneus pleurotænia** Playfair. *Horai-uwo* = Bamboo-fish.

Mullus pleurotænia Playfair, Fishes of Zanzibar, 1866, p. 41, pl. 5, fig. 3.

Pseudupeneus ischyrus Snyder, Proc. U. S. N. M., XXXII, 1907, p. 91, fig. 2. (Tokyo Bay).

Upeneus ischyrus Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 183, fig. 133.

Upeneus pleurotænia Snyder, Proc. U.S.N.M., XLII, 1912, p.501. (Naha, Okinawa).

One specimen from Kagoshima Bay (Wakiya) corresponds well with the type of *Pseudupeneus ischyrus* Snyder, and with the specimen later recorded by the same author as *Upeneus pleurotænia.* The type of *U. ischyrus* still retains definite traces of the peculiar coloration of this species, and the figure shows these markings in part.

Head, 3.15; depth, 3.1; scales in lateral line, 29; dorsal rays VIII–9; anal, 7.

Color in formaldehyde: upper parts very dark, particularly on the scale-margins; a light stripe from near nostrils to near end of soft dorsal fin, curved upward slightly, and interrupted by the upper rim of the eye, becoming obscure posteriorly; a nearly parallel stripe from middle of maxillary, skirting the lower margin of the orbit, extending toward the light saddle across front of caudal peduncle, strongly tinged with red; a third stripe extends from angle of mouth backward and upward, parallel with the upper two, but scarcely evident on body; between the light stripes the dark color is intensified, this being particularly true in a spot at upper end of preopercle; there is a short golden bar below this spot, and another on the interior base of the pectoral fin and a flush of red about these spots, and near the anal fin; the light blotch on the caudal peduncle is bounded posteriorly by a rather indefinite vertical dark bar.

We have also examined material from Hong Kong, China, collected by Walter Fong.

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[94] Proc. U. S. N. M., XXXII, 1907, p. 96.

328. **Upeneus indicus** (Shaw).

This species is represented by a specimen from Kagoshima Bay (Wakiya). Franz (1910) records it from the same place and from Yokohama, but it is not listed by Jordan, Tanaka, and Snyder.

Family APLODACTYLIDÆ.

329. [538] **Goniistius zonatus** (Cuvier and Valenciennes).

Takanoha-dai = Hawk-Tai.

Toba market (Jordan and Yamamoto); Misaki (Aoki).

330. [539] **Goniistius zebra** (Döderlein). *Migimaki.*

A specimen of this rare fish from Misaki (Aoki) corresponds with this species, as contrasted with *Goniistius zebroides* Tanaka.

Family CIRRHITIDÆ.

331. [540] **Cirrhitichthys aureus** (Temminck and Schlegel).

Oki-gonbe = Off-shore Gonbe, or Cirritid.

One specimen from Misaki (Aoki). It closely corresponds with Jordan and Herre's account,[95] differing chiefly in having groups of cirri at the tips of the dorsal spines and on the posterior rim of the anterior nasal flap. The cirri are present on the dorsal spines in the specimen noted by Jordan and Herre, but we find no remaining trace of nasal cirri. The agreement of our specimens with Schlegel's figure, however, is not close, and it is highly possible that the species at hand is still without a name.

Family POLYNEMIDÆ.

332. [543] **Polynemus plebeius** (Broussonet).

Agonashi; *Tsubame-Konoshiro* = Swallow Gizzard-shad.

Shizuoka (Jordan); Misaki (Aoki); Mikawa Bay (Ishikawa).

Our specimens agree well with the excellent figures of this species given by Broussonet and Günther, with the distinctive features of *plebeius* as pointed out by Jordan and McGregor,[96] with specimens of *plebeius* from Samoa, and finally with "cotypes" of *Polydactylus agonasi* Jordan and McGregor in all respects save color. The types of *P. agonasi* seem entirely faded, however, and we see no reason for regarding the Japanese *Polynemus agonasi* as different from *plebeius*. We use the specific name in its original form, *plebeius*.

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[95] Proc. U. S. N. M., XXXIII, 1907, p. 161, fig. 1.

[96] Proc. U. S. N. M., XXX, 1906, p. 814, fig.

Family SILLAGINIDÆ.

333. [544] **Sillago japonica** (Temminck and Schlegel). *Ao-gisu* = Green Gisu.

Osaka, Tokyo, and Kobe markets (Jordan); Toba market (Jordan and Yamamoto); Mikawa Bay (Ishikawa); Toyama (Yoshizawa); Misaki (Aoki); Miyazu, Noo, Fukui (Nonaka). Very common; a choice food-fish, as such much like the English whiting.

Scales 3 to 4–64 to 74; cheek-scales weakly to strongly ctenoid. The specimen from Fukui (Sea of Japan) is young, only 42 mm. long, and is included in a large series of small anchovies, *Engraulis japonicus*.

334. [546] **Sillago parvisquamis** Gill.

Tokyo market (Jordan).

Scales 6.5 to 8–79 to 81–12 to 13. Dorsal, VII–I, 22; anal, I, 23.

Family BRANCHIOSTEGIDÆ.

Genus Branchiostegus Rafinesque.

(*Latilus* Cuvier.)

The name *Branchiostegus* offered in 1814 by Rafinesque as a substitute for *Coryphænoides* Lacépède, (not of Gunner), must unfortunately replace *Latilus*.

335. [548] **Branchiostegus japonicus** (Houttuyn). *Amadai* = Girl Tai.

? Coryphæna branchiostega Gmelin.
Latilus argentatus Cuvier and Valenciennes.

Tokyo market (Jordan); Mikawa Bay (Ishikawa); Toyama; Shizuoka; Yokohama; Kobe; Misaki; Miyazu.

A common and valued, but tasteless, food-fish, the soft flesh extremely white.

We find the coloration and proportions to vary considerably in this genus, and are not able at present to recognize more than one species. This is light red in life, with shadings of blue or purple especially on the caudal, but in spirits it becomes more or less yellow, as described by Houttuyn. If more than one species exists in Japan, Houttuyn's scant description is unidentifiable.

Family CEPOLIDÆ.

336. [555] **Acanthocepola krusensterni** (Temminck and Schlegel).
Akatachi-uwo = Red Sword-fish.

Kobe market (Jordan); Mikawa Bay (Ishikawa); Fukui (Nonaka), Miyazu.

337. [557] **Cepola schlegeli** Bleeker. *Akatachi* = Red Sword-fish.

Dr. Ishikawa sent us one specimen of this species from the Sea of Japan taken at Noo.

Family EMBIOTOCIDÆ.

338. [558] **Ditrema temmincki** Bleeker. *Umi-tanago* = Sea Chub.

Tokyo market (Jordan); Toba (Jordan and Yamamoto); Misaki (Aoki); Fukui (Nonaka). Rather common southward.

Dorsal rays, IX to XI, 20 or 21; anal, III, 24 to 28. The scales are not enlarged in the region between the pectoral and the ventral fins. *Ditrema* thus agrees with *Tæniotoca*, but differs from *Embiotoca*.

In life bluish, with more or less bronze-green or copper-red checks and streaks on the body, one row to each scale-row; the streaks more or less expanded into spots on each scale.

339. [570] **Neoditrema ransonnetii** Steindachner. *Oki-tanago* = Off-shore Chub.

One specimen from the Tokyo market (Jordan).

Dorsal rays, VI, 20; anal rays, III, 26.

Family POMACENTRIDÆ.

340. [563] **Chromis notatus** (Temminck and Schlegel).
Suzumedai = Sparrow-porgy.

Wakanoura (Yamamoto).

341. [564] **Abudefduf saxatilis** (Linnæus). *Oya-bitsuchiya.*

Wakanoura (Yamamoto); Kobe market (Jordan).

The specific name, *saxatilis*, seems to have been intended for this Asiatic species in the Tenth Edition of the *Systema Naturæ*. In the Twelfth Edition it was transferred to the Brazilian form, *Abudefduf marginatus*.

342. [577] **Pomacentrus cœlestis** Jordan and Starks.

Wakanoura (Yamamoto). Very rare.

Family LABRIDÆ.

343. [578] **Chœrodon azurio** (Jordan and Snyder). *Kandai* = Korean Tai.

Osaka and Tokyo markets (Jordan). Not rare.

Dorsal, XIII, 7; anal, III, 10.

344. [579] **Semicossyphus reticulatus** (Cuvier and Valenciennes).

Kobudai = Little Soldier-tai.

Toba (Jordan and Yamamoto).

345. [582] **Pseudolabrus japonicus** (Houttuyn).

Sasanoha-bera = Bamboo-bera or Wrasse.

Yokohama, Tokyo, and Shizuoka markets (Jordan); Toba market (Jordan and Yamamoto); Misaki (Aoki). Common southward.

346. [584] **Duymæria flagellifera** (Cuvier and Valenciennes).

Misaki (Aoki).

347. [588] **Stethojulis terina** Jordan and Snyder.

Kaminari-bera = Thunder-wrasse.

Shizuoka (Jordan); Misaki (Aoki).

Jordan, Tanaka, and Snyder (1913, p. 200) in their Catalogue identify this species with the East Indian *S. kalosoma*. Our formalin specimens, which apparently have preserved their fresh colors, correspond, however, with Jordan and Snyder's color account of *terina*, and not with the descriptions of *S. kalosoma*. We retain the name *terina* for the Japanese form, provisionally regarding it as distinct from *S. kalosoma*.

The species has posterior canines and is therefore a true *Stethojulis*, not a *Hinalea*.

348. [592] **Halichœres pœcilepterus** (Temminck and Schlegel).

Aobera = Blue Bera.

Toba market (Jordan and Yamamoto); Tokyo market (Jordan); Toyama, Misaki (Aoki); Miyazu.

Common, the two sexes quite different, as recognized by Jordan and Snyder, *H. pyrrhogrammus* (Temminck and Schlegel) being the female.

We preserve the original spelling *pœcilepterus*, of Schlegel.

Those who regard *Halichœres* as preoccupied by *Halichœrus* may call this genus *Hemiulis*; *Parajulis* and *Chœrojulis* being synonyms.

349. [595] **Halichœres tenuispinis** (Günther).

Tokyo and Shizuoka markets (Jordan); Misaki (Aoki); Toyama.

Scales 25 in the lateral series, or 27 along the lateral line, not counting 3 on the caudal.

Jordan and Snyder,[97] in recording this species from Japan under the name

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[97] Proc. U. S. N. M., XXIV, 1902, p. 639.

Halichœres bleekeri (Steindachner and Döderlein), state: "It is possible that *Halichœres tenuispinis* (Günther), with the black on the dorsal restricted to a single spot and the ventrals not filamentous and shorter than the pectorals, may prove to be the same species." In our specimens the black on the dorsal extends backward to the third spine in some (as described for *tenuispinis*), or as far as the sixth spine; in one half-grown specimen, otherwise similar, the black spot is little developed; in another entirely absent. The ventral fin may be non-filamentous and shorter than the pectoral on the same fish, in which the opposite fin is slightly filamentous and longer than the pectoral. There remains no basis for the distinction of the Japanese *bleekeri* from the Chinese *tenuispinis*. Further comparison of actual material, however, is to be desired.

One specimen in formalin seems to retain the life-colors, which are as follows: ground-color pink; the scales with green borders, especially on upper posterior fourth of body; three green streaks diverging back from the eye form the anterior ends of horizontal rows of green spots, one on each scale, on the fore part of the body; these head-streaks are green, bordered narrowly with blue and then with deep red; the first extends slightly upward, and is the least definite, the lower one extends slightly downward toward the triangular deep blue spot on the upper edge of the base of the pectoral fin, but before reaching the opercular margin turns upward at right angles. The front portion of the spinous dorsal is banded from the base outward successively by green, red, yellow, and blue-black, then by red and finally green at tip of rays, the black marking being most extensive; elsewhere the fin is pink, bordered by greenish, and then very narrowly by dusky; between each ray, behind the black marking, there is a large round spot of green, red-bordered, between each two rays. The anal fin is pink, pale-margined, and marked by a median red-bordered band of green. The caudal is pinkish, with a basal and a median band and some distal spots of green. The pectoral and ventral fins are pale pinkish, the former fin having the rays margined by pencilled lines of dark red.

350. [599] **Thalassoma cupido** (Temminck and Schlegel).
Nishiki-uwo = Brocade-fish.

Misaki (Aoki).

351. [605] **Iniistius dea** (Temminck and Schlegel). *Tensuidai* = Marked Tai.

Yokohama and Tokyo markets (Jordan).

The lateral black spot covers the greater portion of from one to three scales. Dorsal rays, II–VII, 12; anal, III, 12.

Family SCARIDÆ.

Genus Leptoscarus Swainson.

The name *Leptoscarus* replaces *Calotomus* Gilbert.

352. [607] **Leptoscarus japonicus** (Cuvier and Valenciennes). *Budai* = Soldier-Tai.

Toba market (Jordan and Yamamoto).

Family ZEIDÆ.

353. [610] **Zeus japonicus** Cuvier and Valenciennes. *Mato-dai* = Target Tai.

Tokyo and Osaka markets (Jordan); Kochi (Wakiya); Tatoku Id. (Mikimoto); Kagoshima Bay (Wakiya); Mikawa Bay (M. Ishikawa); Miyazu; Noo; Misaki (Aoki). Generally common.

354. [611] **Zenopsis nebulosus** (Temminck and Schlegel).
Kagami-dai = Mirror Tai.

Tokyo market (Jordan).

Family CHÆTODONTIDÆ.[98]

355. [619] **Chætodon setifer** Bloch. *Toge-chocho-uwo* = Prickly Butterfly-fish.

One young individual, 42 mm. long to the caudal fin, from Shizuoka. This specimen is essentially like the adult, except that the dorsal rays are not produced, and the posterior oblique streaks are rather faint.

356. [621] **Chætodon lunula** (Lacépède). *Tsuki-chocho-uwo* = Moon Butterfly-fish.

One specimen, 45 mm. long to caudal, corresponds closely with a specimen of like size from Samoa, and with the young as figured by Günther in "Fische der Südsee" (plate 33).

357. [623] **Coradion modestum** (Temminck and Schlegel).
Genroku-dai = Elder-Tai.

Osaka market (Jordan); Toba market (Jordan and Yamamoto); Fukui (Nonaka).

Genus Acanthochætodon Bleeker.

This genus, characterized by the lunate caudal, small scales, and gill-membranes narrowly joined to the isthmus, is well distinguished from *Holacanthus*.

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[98] The name *Loa* given by Jordan (Proc. U. S. N. M., 1921, 633) to a species of this family from Hawaii is preoccupied by *Loa* Stiles, 1905, a genus of worms. *Roa* has been substituted for it by Jordan, Copeia, May 20, 1923, p. 63.

358. [624] **Acanthochætodon septentrionalis** (Temminck and Schlegel).
Kinchaku-dai = Purse Tai.

Misaki (Aoki).

359. [626] **Heniochus diphreutes** Jordan. *Hatatate-dai.*

The single young *Heniochus* in the collection was taken by Masashi Ishikawa at the Bay of Mikawa. The anal fin is pale anteriorly.

Family ACANTHURIDÆ.

360. [629] **Naso unicornis** (Forskål). *Tengu-hagi* = Long-nosed Scraper.

One young specimen, 69 mm. long to caudal, from Shizuoka (Jordan).

The frontal horns are yet undeveloped, but the two caudal plates are evident. Dorsal rays, V, 28; anal, II, 28 (the last counted as doubled); ventral, I, 3.

361. [630] **Xesurus scalprum** (Cuvier and Valenciennes). *Sannoji-dai.*

Tokyo and Kobe markets (Jordan); Misaki (Aoki).

Dorsal, IX, 23 or 24; anal, III, 22 or 23. Each of our specimens has only four spines on the caudal peduncle, although some have five.

362. [631] **Acanthurus matoides** (Cuvier and Valenciennes).

Kurohagi = Black Hagi or Surgeon-fish.

Wakanoura (Yamamoto). One young specimen.

Family TEUTHIDÆ.

363. [635] **Teuthis fuscescens** (Houttuyn). *Aigo*; *Ginhagi* = Silver Hagi.

Tokyo and Shizuoka markets (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Fukui (Nonaka); Miyazu.

A common fish often caught from the wharves by boys.

Dorsal, I–XII or XIII, 9 or 10; anal, VI (rarely) or VII, 9. Depth of body 2.4 to 2.9 in standard length, decreasing very irregularly with age.

Family TRIACANTHODIDÆ.

364. [636] **Triacanthodes anomalus** (Temminck and Schlegel).

Benikawamuki = Red Rough Skin (File-fish).

A rare and most interesting fish. Kagoshima Bay (Wakiya).

Family TRIACANTHIDÆ.

365. [637] **Triacanthus brevirostris** Temminck and Schlegel.

Gin-kawamuki = Silver File-fish.

A rare species from Mikawa (Masashi Ishikawa).

Family BALISTIDÆ.

366. [639] **Sufflamen niger** (Park). *Mongara-Kawahagi* = Mongara Rough-skin.

Kochi (Wakiya); Misaki (Aoki).

367. [642] **Canthidermis rotundatus** (Procé).

One specimen of this uncommon form was obtained at Wakanoura (Jordan).

Family MONACANTHIDÆ.

368. [643] **Monacanthus cirrhifer** (Temminck and Schlegel).

Kawahagi = Rough Skin.

Tokyo, Shizuoka, Yokohama, and Kobe markets (Jordan); Toba market (Jordan and Yamamoto); Kagoshima Bay (Wakiya); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Toyama (Yoshizawa); Miyazu, Noo. This File-fish, or Leather-jacket is generally common southward.

Dorsal rays, II–31 to 34.

369. [647] **Cantherines modestus** (Günther).

Umatsura-hagi = Horse-face File-fish.

Osaka market (Jordan); Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa); Misaki (Aoki). Generally common, even northward.

Dorsal, I–35 to 37; anal, 34 (last ray branched from base). The young are marked with several streaks of dark, which in some break into spots much like those of *C. tessellatus*. These become diffuse in the half-grown individuals and disappear in the adult. The group called *Pseudomonacanthus*, characterized by the retrorse spinules on the dorsal spine, shade by degrees into *Cantherines*, in which the spines are merely rough.

370. [647A] **Cantherines tessellatus** (Günther).

Challenger Repts., Shore-Fishes, 1880, p. 54, pl. 23, fig. 13.

Cantherines nigromaculosus Tanaka, Fig. Desc. Fishes Japan, 8 and 9, 1912, pp. 144–196, pl. 38, fig. 145.

Pseudomonacanthus nigromaculatus Jordan and Thompson, Mem. Car. Mus., VI, 1914, p. 267, pl. XXXI, fig. 2 (Specific name misspelled).

Tokyo market (Jordan); Misaki (Aoki).

We refer our material to Tanaka's species *nigromaculosus*, but that nominal form is apparently identical with *Monacanthus tessellatus*, described by Günther from the Philippine Islands.

Our specimens have only 32 or 33 dorsal soft rays (the last counted as double), fewer than in either Tanaka's or Günther's types.

371. [647B] **Cantherines howensis** (Ogilby).

One specimen was obtained at Wakanoura by Yamamoto. It agrees well with Tanaka's description and figure[99] of Japanese material of this species, otherwise known only from Lord Howe Island. We provisionally adopt the synonymy as given by that author.

Dorsal, II–35; anal, 32.

372. [648] **Rudarius ercodes** Jordan and Fowler. *Amime-hagi* = Net-work Hagi.

Misaki (Aoki); Mikawa Bay (M. Ishikawa); Toyama (Yoshizawa).

Dorsal rays, II–23 to 26.

373. [651] **Alutera monoceros** (Osbeck). *Ikkaku-hagi* = Unicorn Hagi.

Tokyo and Kobe markets (Jordan).

Dorsal rays, II–47 or 48.

374. [652] **Alutera liturosa** (Shaw). *Soshi-hagi* = Hoodlum.

Wakanoura (Yamamoto)

Perhaps identical with the Atlantic form *Alutera* (*Osbeckia*) *scripta* (Osbeck).

Genus Tetrosomus Swainson.

We may regard *Tetrosomus* as a valid genus, related to *Lactoria* and to *Triorus*. It may be characterized as follows: carapace closed behind the dorsal and anal fins, pentagonal in cross-section, the dorsal ridge greatly elevated and surmounted by a very large spine; the upper lateral ridges rather sharp, but weak, closely approximated; the lower lateral ridges greatly expanded and bearing five nearly equally spaced spines; sides concave between the ridges; a single supraorbital spine; width of body equal to length to anus.

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[99] Fig. Desc. Fishes Japan, 20, 1915, p. 354, pl. 105, fig. 300. (the figure in Vol. 19).

375. [654] **Tetrosomus gibbosus** (Linnæus).

Known from Japan only by one record, made by Bleeker, and this possibly referring to *Triorus stellifer.*

376. [655] **Ostracion immaculatum** Temminck and Schlegel.
Hakofugu = Box-puffer.

Misaki (Aoki).

377. [656] **Lactoria diaphana** (Bloch and Schneider). *Umi-suzuma* = Sea-sparrow.

Misaki (Aoki).

378. [657] **Lactoria cornuta** (Linnæus). *Kongofugu* = Medley-puffer.

Mikawa Bay (M. Ishikawa).

TRIORUS Jordan and Hubbs, gen. nov.

Orthotype, *Lactophrys tritropis* Snyder = *Ostracion stellifer* Bloch.

Carapace closed behind dorsal and anal fins, triangular in cross-section; the two sides of the triangle convex, but without a ridge behind the supra-orbital ridge, except for a trace in the young; the bottom of the triangle nearly flat; the body very wide; supra-orbital ridge strong, with two spines; dorsal ridge very high and sharp, with two spines; ventral ridges each with four spines, the last remote from the anterior three, the two median spines most closely approximated.

We regard this genus as more closely related to *Tetrasomus* than to the American species now classed together under the name *Lactophrys.*

379. [658A] **Triorus stellifer** (Bloch).

Ostracion gibbosum FRANZ, Abh. Bayer, Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 91 (not of Linnæus).

Lactophrys concatenatus GILCHRIST and THOMPSON, Ann. Durban Museum, I, 1917, p. 423.

One specimen from the Bay of Kagoshima (Wakiya). Twenty others from Misaki (Aoki).

380. [659] **Kentrocapros aculeatus** (Houttuyn).[100] *Itomaki-fugu.*

One specimen of this little Trunk-fish was obtained by Wakiya at Kagoshima. Sixteen taken by Aoki at Misaki. In young, 3.0 to 3.5 cm. long to the caudal fin, the spines on the ridges are represented by mere tubercles. In one adult one of the pair of most prominent superolateral spines is tripartite on one side.

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[100] See McCulloch and Waite, Trans. Roy. Soc. S. Austral., XXXIX, 1915, p. 492.

Family TETRAODONTIDÆ.

381. [662] **Lagocephalus spadiceus** (Richardson).

Saba-fugu = Mackerel puffer; *Gin-fugu* = Silver puffer.

Wakanoura (Yamamoto); Toba (Jordan and Yamamoto); Toyama (S. Yoshizawa); Noo.

This species is best characterized by the extent of the dorsal prickly area. The area is widest midway between verticals from eye and gill-opening, here covering the whole dorsal surface; from this area prickles extend forward in a narrow area, remaining conspicuous, to the nostrils, but obsolescent farther forward; backward from the widest point the area is of similar shape to that before that point, and extends about half-way to the dorsal fin. In some specimens prickles extend farther back in a rather narrow and irregular band in the dorsal line, but they do not even then closely approach the dorsal fin. In the East Indian species *L. lunaris* the dorsal prickly area in contrast extends backward in a but slightly narrowed band to the dorsal fin.

In both species the sides of the trunk and the entire urosome are wholly devoid of prickles. In both the lateral folds of the two sides arise together at the angle of the chin and extend backward, strong throughout their course to the middle of the caudal base, where each is met at an acute angle by the poorly developed dorsal fold of the caudal peduncle.

The two species are unquestionably closely related, but different. Further differences, also pointed out by Bleeker, are noticeable in proportions, *L. spadiceus* having a rather slenderer body and shorter head (a little less rather than a little more than one-third of the total length to caudal).

In addition to the Japanese material of *L. spadiceus* reported on by Jordan and Snyder,[101] we have examined one from Swatow, China, collected by Miss Adele M. Fielde and recorded as *Lagocephalus lunaris* by Rutter,[102] two from Manila, recorded by Jordan and Seale,[103] and by Jordan and Richardson,[104] in each case together with true *L. lunaris* in the same lot as *Sphæroides lunaris*. Of *L. lunaris* we have other Philippine material, two specimens from Hong Kong, collected by Captain Finch, and one from Moreton Bay, Queensland, collected by Ogilby.

A definite color-pattern is sometimes developed in the young, rarely in the adult. It consists of a sharply defined double cross-bar across the back about midway between the pectoral and dorsal fins; a large blackish blotch below the dorsal base; irregular longitudinal blotches along the sides; indefinite cross-shades connecting the darkened supra-orbital ridge, and irregular dark spots on the back, especially distinct on the top of the caudal peduncle, or there united to form an indefinite saddle.

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[101] Proc. U. S. N. M., XXIV, 1901, p. 235.

[102] Proc. Acad. Nat. Sci. Phila., 1897, p. 81.

[103] Jordan and Seale, Bull. Bur. Fish., XXVI, 1906 (1907), p. 36.

[104] Jordan and Richardson, Bull. Bur. Fish. XXVII, 1907 (1908), p. 273.

382. [664] **Sphœroides**[105] **alboplumbeus** (Richardson). *Komon-fugu* = Belly-puffer.

Mikawa Bay (M. Ishikawa); Osaka market (Jordan); Kagoshima Bay (Wakiya); Soo-chow, China (Dr. Cora B. Reeves).

The synonymy of this species is greatly confused. We find no Japanese or Chinese specimens corresponding with *S. oblongus* Bloch of the Indian Ocean, with which *alboplumbeus* has been identified, but we are not certain that the two are really different. The oldest name seems to be *guttulatus* described by Richardson (1845) as a variety of *ocellatus*, and having page-priority over *alboplumbeus*, but later (1846) doubtfully referred to the synonymy of *alboplumbeus* by its describer. All Japanese and Formosan records of *ocellatus* probably refer rather to this species.[106] *Spheroides stictonotus* is probably the adult, as it differs from typical *alboplumbeus* in much the same way as the adult (*abbotti*) of *vermicularis* differs from the half-grown and young. But nearly all of these suggestions require confirmation.

The prickly area extends from between the nostrils backward dorsally to the caudal fin, very closely approaching the dorsal fin, and from this dorsal area downward to include most of the lower surfaces, except on the caudal peduncle; the entire preorbital region to the lateral fold and the chin are without prickles. The prickles are sufficiently enlarged to make the skin rough to the touch on the back from between the eyes half-way or almost to the dorsal fin, on the belly, and sometimes also in lateral bands before and behind the pectoral fins. Where weak, the prickles may become obsolete.

The course of the lateral lines on the snout is variable.

383. [666] **Sphœroides rubripes** (Temminck and Schlegel).
Tora-fugu = Tiger-puffer.

Kobe market, Enoshima (Jordan); Onomichi (Jordan and Snyder).

Young specimens of this species from Onomichi were recorded by Jordan and Snyder[107] as *Spheroides alboplumbeus*.

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[105] The name *Sphœroides* (1798) antedates *Spheroides* 1806.

[106] Philippine records of *S. ocellatus* (Jordan and Seale, Proc. U. S. N. M., XXVIII, 1905, p. 791, and Bull. Bur. Fish. XXVI, 1906 (1907), p. 36), refer to *Chelonodon patoca*, as we have determined by re-examining the material so recorded. A Chinese record of *Lagocephalus ocellatus* Abbott (not Osbeck), refers to *Spheroides macclellandi* Regan.

[107] Proc. U. S. N. M., XXIV, 1901, p. 244.

With age the pectoral spot becomes blacker and more strongly ocellated, rather than grading into the general color scheme. Moreover additional, or postpectoral, ocelli become developed. The prickles commence well behind the lips, not far in advance of the nostrils, and extend backward to within a short distance of the dorsal fin, where the patch is abruptly truncated and completely terminated, except for a few prickles, which extend along the lateral line below the dorsal base. The ventral patch extends from the angle of the chin almost to the anus. The two patches are either separated or very narrowly joined before and behind pectoral fins. Wide areas about the mouth, eyes, and gill-openings, and almost the entire tail are wholly devoid of prickles. Wherever the prickles occur they are large and strong, being readily visible to the unaided eye, and very sharp. Dorsal rays 16 or 17.

The use of the inflated skins of this large species as ornamental lanterns is a specialty of Enoshima.

383a [668] **Sphœroides** (Temminck and Schlegel).

Yokohama, Tokyo, Toba (Jordan); Mikawa (M. Ishikawa); Misaki (Aoki).

383b [670] **Sphœroides pardalis** (Temminck and Schlegel).

Toba (Jordan); Fukui (Nonaka); Misaki (Aoki).

Family SCORPÆNIDÆ.

383c [697] **Sebastolobus macrochir** (Günther).

Western Hokkaido (Majima); Kushiro, Nemuro (Tanaka); Misaki (Aoki).

Genus Sebastodes Gill. (*Mebaru*; *Soi*).

For the present we refer all the Japanese species allied to *Sebastes*, but having only thirteen or fourteen dorsal spines, to the single genus *Sebastodes*. We realize perfectly that not one of the Japanese forms is naturally congeneric with *Sebastodes paucispinis*, the Californian type of the genus, nor yet with *nigrocinctus*, the type of the genus *Sebastichthys*, a Californian species, which stands at the opposite extreme of the series of fifty or more known forms. It will be necessary to break up the group into from five to ten genera, but the divisions, thus far proposed, fail to satisfy, as the characters lack definiteness, or are subject to intergradation. It seems best to leave the arrangement of genera to some monographer. We may note, that, the more extensive the material in hand, the more difficult the problem, as appears in Frank Cramer's elaborate paper on the "Cranial Characters of Sebastodes" (Cal. Ac. Sci., V, 1895).

The evolution of the group from Miocene forms (*Sebastoessus*, *Rixator*, etc.) allied to *Sebastodes* revealing greater and greater divergence and modification of the cranium is evident.

The Japanese species of this group may be provisionally referred to the following subgenera, already more or less fully defined, but by no means adequately covering the entire group.

Emmelas Jordan and Evermann, *glaucus*.

Primospina (Eigenmann and Beeson) *owstoni*, *sasakii*.

Sebastosomus Gill, *inermis*, *tokionis*, *joyneri*, *thompsoni*, *schlegeli*, *taczanowskii*, *flammeus*, *itinus*, *steindachneri*.

Acutomentum Eigenmann, *matsubaræ*, *iracundus*, *scythropus*.

Rosicola Jordan and Evermann, *fuscescens*.

Pteropodus Eigenmann, *vulpes*, *nivosus*, *trivittatus*, *mitsukurii*, *pachycephalus*.

Sebastocles[108] Jordan and Hubbs, *elegans*.

Subgenus *Primospina* Eigenmann and Beeson.

384. [687A] **Sebastodes (Primospina) owstoni** Jordan and Thompson.

Toyama (Yoshizawa); Noo.

This species is represented in the present collection by five small specimens (97 to 130 mm. long), all from the Sea of Japan. All of the specimens have fourteen dorsal spines.

The color in life was obviously red, marked with about five indefinite dark saddles along the back, of which the one below the tenth and eleventh dorsal spines is the most conspicuous.

385. [687B] **Sebastodes (Primospina) sasakii** Tanaka.

This species seems to be known only from the original description published in Japanese.[109] We give here a translation of the original description, made for us by Mr. Kasawa:

'Head 2.9 in length of body; depth, 3.0. Diameter of eye 4.5 in head; interorbital width, 3.5; snout 3.33; maxillary 2.1; depth of caudal peduncle, 4.0. D. XIII, 15; A. III, 7; pectoral, 19, all soft, the first and last unbranched, the first eight branched, the last nine unbranched, thickened; V. I, 5; C, about 12 (branched rays only counted). Scales about 115 in lateral line; 15 between D. and lat. 1.; 27 between lat. 1. and anal; pores about 59. Gill-rakers 28; longest gill-rakers 1.5

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[108] *Sebastocles* Jordan and Hubbs, subgen. nov. Dorsal spines low, normally fourteen; interorbital deeply concave, size small. Type *Sebastes elegans* Steindachner.

[109] Zoöl. Mag., XXVIII, No. 333, p. 257.

in eye. Body elongate, not elevated, evenly rounded. Maxillary not reaching to anterior margin of pupil. Pectoral fin reaching beyond ventral fin, but not to anus; distance from tip of pectoral to origin of anal equals length of V. Caudal fin emarginate. Scales ctenoid. Maxillary scaled.

'In formalin color brownish red, pale ventrally; irregular brownish black blotches on sides; about five wide bars above lateral line; many irregular spots between bars. Four brownish bands about eye, one band across the head in front of eyes; one band branched behind eye, one branch extending across head back of eye, the other branch running along side of body; next band below eye also branched, one branch running to opercle, one branch extending obliquely downward and backward; the last band extending downward and forward from eye. Another band on interorbital space, not touching eye. Very little black on lower part of opercles; belly pale.

'Specimen taken in deep water (about 120 fathoms).

'Named for Madoka Sasaki, professor of fisheries, Imperial University of Hokkaido.

'Caught off the coast of Rikuzen (Matsushima).'

Subgenus *Sebastosomus* Gill.

386. [689] **Sebastodes (Sebastosomus) inermis** (Cuvier and Valenciennes).

Kuro-soi = Black Rock-cod.

Sebastes inermis CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 346.—HILGENDORF, Sitzungsb. Ges. Nat. Freunde. Berlin, 1880, p.172.

Sebastodes inermis JORDAN and STARKS, Proc. U. S. N. M., XXVII, 1904, p. 103.—FRANZ, Abh. Bay. Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 70.—SNYDER, Proc. U. S. N. M., XLII, 1912, p. 425.—JORDAN and METZ, Ann. Car. Mus., VI, 1913, p. 51.—JORDAN and THOMPSON, *ibid.*, VII, 1914, p. 271.

Sebastodes ventricosus TEMMINCK and SCHLEGEL, Fauna Japonica, Pisces, 1843, p. 48, pl. 20, figs. 1, 2.—BLEEKER, Verh. Bat. Gen., XXVI, 1859, p. 80.—NYSTRÖM, Kong. Verh. Handl., 1887, p. 20.

Sebastodes fuscescens JORDAN and SNYDER, Proc. U. S. N. M., XXIII, 1900, p. 756 (Probably not of Houttuyn).

Sebastodes guntheri JORDAN and STARKS, Proc. U. S. N. M., XXVII, 1904, p. 102, fig. 2.—JORDAN and METZ, Ann. Car. Mus., VI, 1913, p. 49, fig. 43.

Tokyo and Yokohama markets (Jordan); Toba (Jordan and Yamamoto); Misaki (Aoki); Mikawa Bay (M. Ishikawa).

Snyder, and Jordan and Thompson were undoubtedly right in referring *guntheri* to the synonymy of *inermis*.

Snyder expresses doubt as to whether Cuvier and Valenciennes had the species, now called *inermis* or *tokionis* in mind, and suggests that *Sebastes ventricosus* and *Sebastodes tokionis* are identical. In our opinion, however, Schlegel's figure of *ventricosus* is assuredly not based on a specimen of *tokionis*, and agrees in detail with *inermis*, and not with any other species of the *inermis* group. Hilgendorf, furthermore, compared the type of *inermis* with a specimen identified by Schlegel as *ventricosus* and declares the two to be identical. Consequently, until contrary evidence is forthcoming, we propose to regard *ventricosus* as a synonym of *inermis*, and to continue to apply the name *inermis* to the species here discussed. It is probable, however, that the descriptions of Günther (*ventricosus*) and of Steindachner (*inermis*) were based on specimens of *tokionis*.

Sebastodes inermis is typical of a complex group of species, the genus *Sebastosomus* of Gill, which differ widely from other species of *Sebastodes*, and agree among themselves in nearly all trenchant characters. In all of these forms the head is nearly smooth, the supraorbital and occipital ridges being weak; nasal, preorbital, postorbital, and occipital spines alone are developed on the top of the head, and they are small and rather depressed; the preorbital is armed by two sharp spines directed downward and backward; behind them the suborbital is extremely narrow; of the two opercular spines the upper is the larger; the five preopercular spines are all directed backward; of these the first is very small, the second much the largest; the interorbital is evenly and very slightly convex and rather broad; the gill-rakers are long and slender, twenty-four to twenty-seven in number on lower limb of first arch; the mandible projects as a rather sharp knob, and a double symphyseal knob is developed; the broad end of the maxillary extends about to below the middle of orbit; the suborbital stay is complete; the head is covered with ctenoid scales to the lips, the snout, preorbital, suborbital, maxillary, mandible, exposed gular and branchiostegal regions, all being closely scaled; the body-scales are of moderate size, the pores thirty-four to fifty-three in number; there are few accessory scales; the dorsal fin is of moderate height, and composed of thirteen spines and twelve to fifteen soft rays; the anal rays are III, 5 to 8; the paired fins are pointed and long; the anus is well in advance of the anal fin; the peritoneum in all is white.

In addition to *S. inermis* this group includes *tokionis*, *joyneri*, and *thompsoni*.

These four species may be divided into two groups. In the first pair, *inermis* and *tokionis*, the caudal fin is strictly truncate, and the ventral fin is very long, reaching far beyond the anus, which is distant about two-thirds the orbital length from the anal fin. In the other two species, *joyneri* and *thompsoni*, the caudal fin is distinctly emarginate and sharply lobed; the ventral fin is shorter, reaching but little, or not at all, beyond the anus; the anus is distant the full length of the orbit from the anal fin.

Description of *Sebastodes inermis*: Dorsal rays, XIII, 12 to 15, most frequently 14; anal rays, III, 5 to 8, usually 7 or 8. Pores in lateral line to caudal base, 39 to 47 (the type of *guntheri* has 42, not 50 pores, as described); scales vertically below first dorsal spine, to lateral line, 11 to 17; scales in an oblique row from first anal spine to lateral line, 18 to 27. Scales somewhat rougher and firmer than in related species, and with more accessory scales at bases; each scale near middle of body, above lateral line, with 7 to 12, usually 9 to 11, radii. Back rather strongly elevated, depth of body greater than length of the head, and contained 2.4 to 2.7 times in standard length. Length of orbit 2.9 (rarely) to 3.4 in head to end of opercular flap, and 1.15 to 1.4 times the interorbital width (1.45 to 1.6 times interorbital in young); length of upper jaw, 2.2 to 2.4 in head; length of ventral spine 1.4 to 1.9 in total length of fin.

Color brassy green to reddish brown or blackish, becoming dusky silvery to dull reddish below; the sides crossed by wide, indistinct, and much disrupted cross-bands, which are about as well developed below as above the lateral line; young boldly marked with rather large spots, which later merge with the bars.

387. [691] **Sebastodes (Sebastosomus) tokionis** Jordan and Starks.

Aka-mebaru = Red Rock-cod.

Sebastes ventricosus Günther, Cat. Fishes Brit. Mus., II, 1860, p. 97 (not of Temminck and Schlegel).

Sebastodes ventricosus Jordan and Evermann, Bull. U. S. N. M., XLVII, pt. 2, 1898, p. 1829 (after Günther).

Sebastes inermis Steindachner and Döderlein, Denksch. Akad. Wiss. Wien, 1884, p. 205 (not of Cuvier and Valenciennes).

Sebastodes inermis Jordan and Evermann, *l. c.*, p. 1829 (after Steindachner and Döderlein).

Sebastodes tokionis Jordan and Starks, Proc. U. S. N. M., XXVII, 1904, p. 104 fig. 3.—Franz, Abh. Bay. Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 70.—Snyder, Proc. U. S. N. M., XLII, 1912, p. 425.—Jordan and Thompson, Mem. Car. Mus., VI, 1914, p. 425, fig. 40.

Osaka market (Jordan); Misaki (Aoki); Toba (Jordan and Yamamoto).

The proportionate measurements of depth of body and of eye, as given by Günther and by Steindachner, indicate that they had before them the present species, rather than *S. inermis*. This species is extremely close to *Sebastodes inermis*, but differs in having a lower average number of pores and scales, a higher average number of radii on the scales, the back not elevated, and the body slenderer, the eye usually much larger (at comparable sizes), and the color in life lighter and redder.

Description of *Sebastodes tokionis* (based on the material listed above, on the type and four paratypes from Misaki, and one specimen from Tokyo, collected by Jordan and Snyder in 1900): Dorsal rays, XIII, 13 to 15; anal rays, III, 6 to 8. Pores in lateral line to caudal base, 35 to 45, usually fewer than 42 (in the type we count 39); scales below first dorsal spine, 11 to 14; obliquely above first anal spine, 17 to 22 (in each case to lateral line). Scales near middle of body, above lateral line, averaging somewhat longer and more widely exposed than in related species, each with 8 to 15, usually 10 or more, radii. Dorsal contour much less elevated than in *S. inermis* and more gently curved, the greatest depth consequently less, about equal to length of head, contained 2.7 to 2.9 times in length to caudal. Orbit very large, 2.7 to 3.2 in head; in the adult 1.4 to 1.65, and in the young 1.55 to 1.65 times the interorbital width; length of upper jaw 2.3 to 2.4 in head; length of ventral spine, 1.55 to 1.85 in total length of fin.

Color of a fresh specimen brown above, becoming bright red on lower parts; the dorsal dusky, becoming blackish outwardly, but with the margins of the membranes from the fifth to the tenth spines red; all other fins red; nasal tubes bright red. In alcohol the back is dusky (lighter than in *S. inermis*), the lower parts silvery; dorsals, anal, and tip of ventral dusky; pectorals colorless. In the young the fins are darker, and the sides are marked with spots, which, though clearly evident, are smaller, more numerous, and less distinct than in the young of *S. inermis*. Adults are indefinitely marked with cross-bars, which are well shown in the figure of the type; these, as in *S. inermis*, are about as well developed on the lower side as above the lateral line, and are nowhere sharply defined.

388. [692] **Sebastodes (Sebastosomus) joyneri** (Günther).

Takenoko-mebaru = Bamboo Rock-cod.

Sebastes joyneri Günther, Ann. Mag. Nat. Hist., I, 1878, p. 485; Challenger Reports, Shore-Fishes, 1880, p. 64, pl. 29, fig. A.—Steindachner and Döderlein, Denksch. Acad. Wiss. Wien, 1884, p. 206.

Sebastodes joyneri Jordan and Evermann, Bull. U. S. N. M., XLVII, pt. 2, 1898, p. 1829 (after Steindachner and Döderlein).—Jordan and Snyder, Proc. U. S. N. M., XXIII, 1900, p. 757 (in part).—Jordan and Starks, Proc. U. S. N. M., XXIII, 1900, p. 105 (in part, not specimens from Miyako).—Snyder, Proc. U. S. N. M., XLII, 1912, p. 426.

Shizuoka (Jordan).

We separate from *S. joyneri*, as representatives of a new species, which we name *Sebastodes thompsoni*, certain specimens, which hitherto have been confounded with this species. Excluding these we have seven specimens (five previously recorded) which correspond in full detail with the descriptions of Günther and Steindachner. These specimens serve as the basis for the description which follows.[110]

Description of *Sebastodes joyneri*: Dorsal rays XIII, 14 or 15; anal rays, III, 7 or 8; pores in lateral line 43 to 51 (42 to 49 counted by Steindachner); 13 to 15 scales between lateral line and origin of dorsal, 24 to 29 scales to origin of anal; scales near middle of body and above lateral line with 8 to 13 radii. Both contours rather evenly curved, the body rather slender, its greatest depth 2.7 to 2.9 in length to caudal; orbit very large, its length 2.65 to 3.4 in head to end of flap, 1.2 to 1.7 times the interorbital width; length of upper jaw, 2.35 to 2.5 in head; length of ventral spine, 1.4 to 1.75 in total length of fin.

Color red, a little darker above, with highly intensified and sharply margined oblique black bars of constant form, five partly below and partly on dorsal base; first composed of two separated rounded spots, one at base of fin and one on lateral line; the second bilobed, extending a little below lateral line; the third comma-shaped, barely extending below lateral line, the ventral end showing some variation, sometimes being partly or completely separated from the rest of the bar, the detached portion rarely divided vertically; fourth round, extending only half-way to lateral line; the fifth smaller and squarer in shape, a saddle across caudal peduncle at end of dorsal base, extending a little out on fin, but not to latest line; the sixth a small spot at upper edge of caudal base. Largest specimen 188 mm. long to caudal.

389. [692A] **Sebastodes (Sebastosomus) thompsoni** Jordan and Hubbs, sp. nov.

Sebastodes joyneri Jordan and Snyder, Proc. U. S. N. M., XXIII, 1900, p. 757 (in part).—Jordan and Starks, Proc. U. S. N. M., XXVII, 1904, p. 105 (specimen from Miyako).—Jordan and Thompson, Mem. Car. Mus., VI, 1914, p. 271, pl. XXXII, fig. 2. (Specimen from Tsushima Straits).

This species is nearest *Sebastodes joyneri*, with which it has heretofore been confused, but differs sharply in coloration, as is well shown in the figures of the two species. The pores in the lateral line are more numerous (52 or 53) than in any other species of the *inermis*-group.

Type, 189 mm. long to caudal fin, collected by Jordan and Snyder (in 1900) at Miyako, Japan; Cat. No. 7167, Stanford University Collections. Paratypes of about the same size were collected by Doctor Jordan (in 1911) at Osaka; Cat. No. 22640, Stanford collections (No. 6037a Car. Mus. Cat. Fishes).

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[110] For certain other characters of *S. joyneri* see the comparisons made under *S. inermis*, p. 262.

Head, 2.85 to 3.05; depth, 2.7 to 2.9. Body rather slender, the back not especially elevated; the dorsal and ventral contours about equally curved. Head rather smooth, supraorbital and occipital ridges being low and partly scaled over; nasal, preorbital, postorbital, and occipital spines alone developed on top of head, all small and depressed; preorbital armed by two sharp spines (one bifid in type) directed downward and backward; suborbital extremely narrow; upper opercular spine the longer; five preopercular spines, the first very small, the second much the largest, those following progressively shorter, all directed backward. Interorbital nearly smooth, very slightly convex, its edges nowhere gibbous, its least width 1.35 to 1.6 in orbit; suborbital stay complete; orbit, 3.2 to 3.25 in head; maxillary, 2.2 to 2.4, its broad end reaching to below middle of orbit; mandible projecting as a rather sharp knob; a double symphyseal knob of teeth fitting into interspace between expanded anterior lobes of premaxillary teeth; sides of jaws and palatines with narrow bands of teeth; gill-rakers rather long and slender, twenty-seven on lower limb of outer arch. Head covered with ctenoid scales to the lips, the snout, preorbital, suborbital, maxillary, mandible, and exposed portions of gular and branchiostegal membranes all being closely scaled. Body-scales rather smaller than in related species, the pores of lateral line numbering 52 or 53 to caudal base; about 17 scales in a series from first dorsal spine vertically

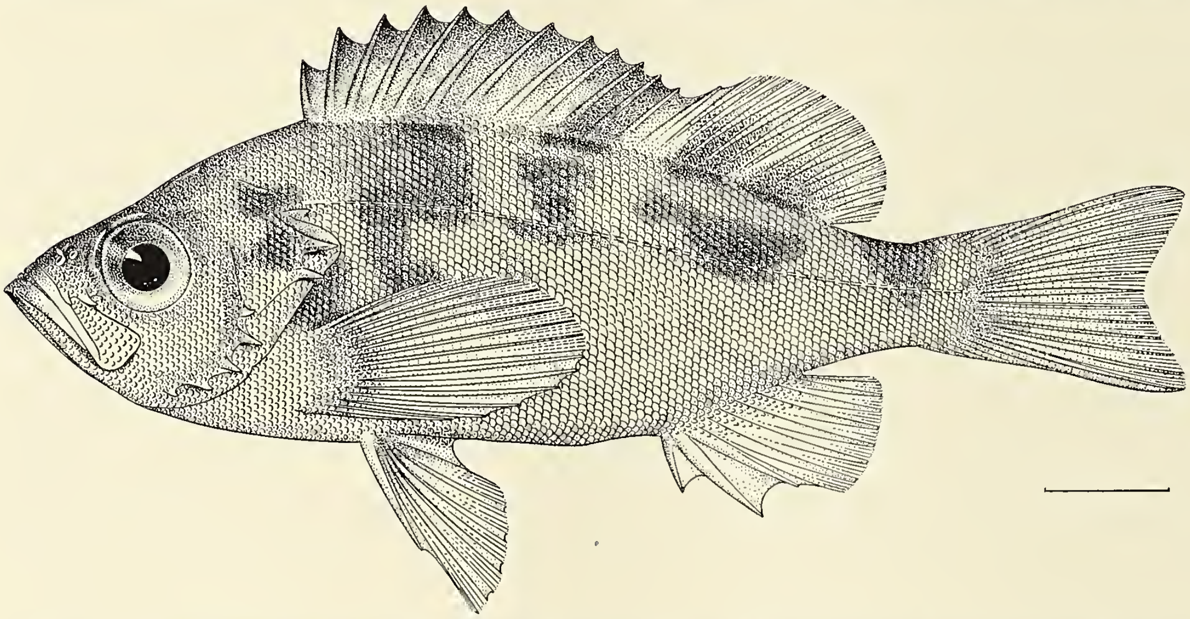

FIG. 1. *Sebastodes thompsoni* Jordan and Hubbs, sp. nov. Reproduction of the figure of *S. joyneri* Jordan and Thompson, Mem. C. M., VI, Pl. XXXII, fig. 2.

downward to lateral line, 28 to 30 in an oblique row from first anal spine to lateral line. Accessory scales few, except on nape and along base of dorsal. Scales with about eleven radii. Dorsal rays, XIII, 14; anal, III, 7; pectorals, 16. Dorsal spines short and moderately robust, the fourth or fifth longest, a little longer than highest soft ray, contained 2.3 to 2.4 times in head; membranes between dorsal spines not deeply incised; the dorsals not very deeply emarginate. Caudal distinctly emarginate; the lobes rather sharp. Third anal spine about as strong as second and a little longer, a little more than two-thirds the longest soft ray, 2.4 to 2.7 in head. Ventral pointed, scarcely extended beyond anus, the length of the fin 1.6 to 1.65 times the length of the spine, contained 1.55 to 1.65 times in head. Pectoral rather pointed, reaching to above anus, 1.2 in head. Unbranched pectoral rays not enlarged. Anus in advance of anal fin a distance about equal to length of orbit. Peritoneum white.

Color doubtless red in life; in spirits dusky above, and silvery below the lateral line. Upper sides marked with dark brown bars, not black as in *S. joyneri*, and of different form. The form of the bars is better indicated by the figure than by description. Mem. Car. Mus., Vol. VI, pl. XXXII, fig. 2.

390. [690] **Sebastodes (Sebastosomus) schlegeli** (Hilgendorf).

Kuro-mebaru = Black Rock-cod.

Otaru market (S. Takayasu); Sapporo market (Majima).

391. [695] **Sebastodes (Sebastosomus) steindachneri** (Hilgendorf).

Yanagi-mebaru = Willow Rock-cod.

A single specimen taken by Tanaka at Nemuro.

Dorsal rays, XIII, 15; anal, III, 7; pectoral rays, 1, 9, 8 = 18; pores, 32; head, 2.7; depth, 2.7; orbit, 4; snout, 4.

392. [697] **Sebastodes (Sebastosomus) taczanowskii** (Steindachner).

Otaru market (Takayasu); Sapporo market (Majima).

In this species there is wide variation in structural features. The postorbital spine may be either absent, or present; the posterior suborbital lobe may become divided into two parts; scales sometimes extend forward on the mandible over the articular bone, and along the upper edge, and sometimes even scatteringly over the posterior outer face of the dentary bone. The body, when fresh, shows more or less distinctly pearly spots on the centers of scales on the sides.

393. [698] **Sebastodes (Sebastosomus) flammeus** Jordan and Starks.

Hi-mebaru = Scarlet Rock-cod.

One specimen, 345 mm. long to the caudal fin, taken at Kushiro by Tanaka, agrees well with Jordan and Thompson's redescription and figure of this species.[111]

Measurements in hundredths of length to caudal: head (to end of opercular membrane) .40; upper jaw, .175; snout, .10; mandible, .225; pectoral, .28; ventral fin, .185; ventral spine, .102; fourth dorsal spine, .105; third anal spine, .098; bony interorbital, .083; depth of caudal peduncle, .10.

Dorsal rays, XIII, 15; anal, III, 8; pores in the lateral line, 33; gill-rakers, 1+20. The teeth of the upper jaw are in a band anteriorly, the few next the anterior notch being canines, in a double series of fairly strong incurved teeth medially, and in a band of fine teeth near the angle of the gape. The mandibular teeth are developed as a group of small canines on the strong symphysial knob, but rapidly narrow to a single series, which extends along the entire sides of the jaws.

The dark blotch mentioned by Jordan and Snyder is not on the opercular flap, but on the upper part of the branchiostegal membrane. The membrane above the anterior half of uppermost branchiostegal is also brownish black. These two marks, ordinarily concealed, are sharply diagnostic of the species.

Subgenus *Acutomentum* Eigenmann.

394. [700] **Sebastodes (Acutomentum) iracundus** Jordan and Starks.

Itten-ako = Spot Rock-fisk.

Sebastes matsubaræ var., Hilgendorf, Sitzungsber. Ges. Naturforsch. Freunde, Berlin, 1880, p. 170, and plate.

Sapporo market (Majima); Kushiro (Tanaka).

The four specimens fully agree with the fish recorded under the above name by Snyder,[112] from Mororan. They differ from the type chiefly in coloration, which is probably largely due to changes in preservation. The black blotch on the side of the large type, as described, is very much smaller on one side than on the other; such irregular spots appear on various Californian species of the genus.

In the following counts and measurements the items applying to the large type are put in parentheses, when different from the measurements taken from the five other specimens at hand.

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[111] Mem. Car. Mus., VI, 1914, p. 270, pl. XXXII, fig. 1.

[112] Proc. U. S. N. M., XLII, 1912, p. 426.

Dorsal rays, XIII, 14 (13); anal rays, III, 8; pectoral rays, distinguishing branched and unbranched rays, 1 or 2+8 or 9 (9 or 10)+8 or 9 (9) = 18 or 19 (19 or 20); pores, 30 to 35 (30). Head, 2.55 to 2.6 (2.45), depth, 2.4 to 2.6 (2.8); depth of caudal peduncle, 3.7 to 4.1 (4.7); orbit, 3.3 to 3.5 (3.8); interorbital, 4.6 to 5.1 (5.1); snout, 3.8 to 4.1 (4.25); upper jaw, 1.9 to 2.1 (2.1). Scales covering all exposed surfaces of the head, excepting only the eyes and lips, everywhere ctenoid. Teeth in a moderate band in premaxillaries, somewhat enlarged anteriorly; mandibular teeth coarse on the small symphysial knob, chiefly in one series of strong teeth, laterally flanked to well toward the end of the series by one or two irregular rows of smaller teeth. Spines of head subject to much variation; supraocular spine occasionally reduced to a sharp knob; coronal spines indifferently present or absent, directed outward or backward, and varying in position; nuchal spines distinct, or more or less completely fused with the parietals. Lower border of orbit without a raised and broken crest, but sometimes showing a small spine at base of the upper edge of suborbital stay. Interorbital flat or weakly concave, with a pair of very weak to rather strong ridges.

Color red, with dusky markings arranged in diagnostic fashion. Three narrow bars cross the top of the head at the front and back of orbit and at nape; rather faint cross-bars or wedges extend downward from about the front of the dorsal to the black opercular blotch, from the middle of the spinous across the lateral line, and as irregular fragments well toward the ventral fins, from near the end of the spinous dorsal not nearly to the lateral line, and from below the end of soft dorsal base almost to lateral line; a longitudinal row of spots, more or less blurred into blotches, opposite the dark bars, extends along the body just above and below the lateral line, the ventral series being the more conspicuous. A dark blotch on the branchiostegal membrane near opercular spot, and a variable amount of like color on the hidden portion of the membrane medially. Buccal and branchial cavities coarsely blotched with black; peritoneum black.

395. [693] **Sebastodes (Acutomentum) scythropus** Jordan and Snyder.
Ukeguchi-mebaru = Lucky-mouth Rock-cod.

A ripe female, 202 mm. long to the caudal fin, was obtained in the Yokohama market (Jordan).

Dorsal, XIII, 12; anal, III, 5 (counting last rays as branched); second anal spine little longer than third.

Ground-color pale pinkish, becoming silvery below, and marked dorsally by large orange-red blotches, broadly bordered with bluish gray, and arranged as follows: a streak along front of lateral line ending in a large blotch below middle of spinous dorsal; a similar streak between lateral line and dorsal; four blotches diagonally disposed about the one mentioned above, the foremost behind opercle, the upper two extended into dorsal base, the one under the four last spines of the first dorsal fin wedge-shaped; the fourth blotch indefinitely connected along lower sides with the lower end of a prominent bar below soft dorsal; another bar on caudal peduncle near base of caudal. Head pale, with some mottling of bluish dusky above, and with a large and conspicuous rich deep brown opercular blotch. Dorsal fins with extensions of the red body-markings, and with red dashes in the membranes distally. Caudal and ventrals red; pectorals and anal pinkish.

Subgenus *Pteropodus* Eigenmann.

396. [702] **Sebastodes (Pteropodus) vulpes** (Steindachner and Döderlein).
Ma-soi = True Rock-cod; *Kitsune-mebaru* = Fox Rock-cod.

Otaru market (Takayasu).

397. [703] **Sebastodes (Pteropodus) pachycephalus** (Temminck and Schlegel.)
Hachigara = Cranium-belly; *Mura-soi* = Irregular Rock-cod.

Otaru market (Takayasu); Yokohama market (Jordan); Toyama (S. Yoshizawa).

398. [706] **Sebastodes (Pteropodus) mitsukurii** (Cramer).

Toba market (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Fukui (Nonaka).

Young, about 4 cm. long to caudal, are very similar to the adult in form and color, differing chiefly in having the gill-rakers about one-third as long as the orbit.

399. [708] **Sebastodes (Pteropodus) trivittatus** (Hilgendorf).
Shimazoi = Striped Rock-cod.

Otaru market (Takayasu); Nemuro (Tanaka).

Dorsal rays, XIII, 13; anal, 6; pores, 38.

Subgenus *Sebastocles** Jordan and Hubbs.

400. [704] **Sebastodes (Sebastocles) elegans** (Steindachner and Döderlein).
Yoroi-mebaru = Mailed Rock-cod.

Misaki (Aoki).

Ripe females are 13 to 15 cm. long to caudal.

All four specimens have fourteen dorsal spines. This dainty little fish is especially characteristic of the Inland Sea.

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* See footnote No. 108, p. 260.

Genus SCORPÆNODES Bleeker.

This name replaces *Sebastopsis* Gill, and *Sebastopsis* Sauvage. *Sebastella* Tanaka (1918) appears to be another synonym.

401. [709] **Scorpænodes littoralis** (Tanaka). *Iso-kasago* = Surf Scorpion-fish.

Sebastella littoralis TANAKA, Zoöl. Mag., XXIX, 1918, p. 10.

We offer a translation of the original account of this species, which was in Japanese:

'Head 2.66 in length of body without caudal fin; depth 3. Diameter of eye 3.875; interorbital, 6.89; snout, 3.44; maxillary, 1.77; caudal peduncle, 3.875. Dorsal, XIII, 9; anal, III, 5; pectoral fin, 17, the lower nine rays unbranched; ventral, I, 5; caudal, 11 (branched rays). Scales in series upon lateral line, 46; 6 above, 11 below lateral line. Teeth on both jaws and on vomer, but not on palatines. Second anal spine stronger and longer than third. Tip of pectoral fin reaching a little beyond origin of anal; ventral fin not reaching anal origin. Caudal rounded.

Color in formalin brown. Six indistinct oblique bars on the sides; three bands radiating downward from the eye; subopercle with a large blotch; many brown spots and streaks on all the fins. Length from front of head to tip of middle caudal rays 99 mm.'

This fish is abundant along the shore at Misaki, and does not attain a large size, a fact which accounts for its not being brought into the markets.

It resembles some species called *Sebastodes*, but differs in having no teeth on the palatine bones.

402. [710] **Sebasticus albofasciatus** (Lacépède).
Ayame-kasago = Bright-colored Kasago.

Shizuoka and Osaka markets (Jordan); Misaki (Aoki).

The subocular spine is absent in all our specimens but one, on which it occurs on but one side. Dorsal spines normally 12, but occasionally 11 or 13. In large adults the eye is less than one-fourth as long as the head, but in specimens of similar size, the eye is larger than in *S. marmoratus*.

403. [711] **Sebastiscus marmoratus** (Cuvier and Valenciennes). *Kasago.*

Sebastiscus tsuraara TANAKA, Zoöl. Mag., Vol. XXIX, No. 339, 1917, p. 10 (Misaki).

Shizuoka, Tokyo, and Kobe markets (Jordan); Misaki (Aoki); Mikawa Bay (M. Ishikawa).

This species varies much in color and pattern, grading from blackish to reddish brown, but not approaching, so far as known, the red color (fading to white in alcohol) characteristic of *S. albofasciatus*. One of the darker color phases has lately been distinguished specifically by Tanaka as *S. tsuraara*, but we do not think the form so named to be separable. In this species the spine on the suborbital stay near the lower margin of the orbit is but rarely developed, but it is also frequently, perhaps usually, absent in *albofasciatus*. These two forms are very closely related, and indeed *albofasciatus* may be merely the deep-water race of *marmoratus*, and it is likely that Jordan and Thompson (1914) are right in uniting the two, under the older name *albofasciatus*.

404. [714] **Helicolenus emblemarius** Jordan and Starks.

Yokohama market (Jordan).

405. [715] **Scorpæna neglecta** Temminck and Schlegel.
Fusa-kasago = Fringe Kasago.

Misaki (Aoki).

406. [716] **Scorpæna izensis** Jordan and Starks.

Misaki (Aoki); Miyazu.

407. [717] **Scorpænopsis cirrhosa** (Thunberg). *Oni-kasago* = Devil Kasago.

Kobe market (Jordan).

Snyder's record of this species from Kagoshima refers to *S. gibbosa*. The two species are, however, well distinguished.

Head 2.25 to 2.3; depth, 3.1 to 3.4; orbit, 5.4 to 6.1; dorsal rays, XII, 8 or 9; anal, III, 5.

408. [719] **Scorpænopsis gibbosa** (Bloch and Schneider).

Scorpæna gibbosa Bloch and Schneider, Ichth., 1801, p. 192, pl. 44.—Günther, Fische der Südsee, I, 1874, p. 79, pl. 53; Cat. Fishes Brit. Mus., II, 1860, p. 119. —Bleeker, Verh. Akad. Amster. XVI, 1876, p. 38, pl. 2, fig. 1; Atl. Ichth., IX, 1877, pl. 416, fig. 4 and 4a.

Scorpæna kagoshimana Döderlein, Denksch. Akad. Wiss. Wien, 49, 1884, p. 28; *ibid.*, 53, 1887, pl. 3.

Scorpænopsis kagoshimana JORDAN and STARKS, Proc. U. S. N. M., XXVII, 1904, p. 137.—SMITH and POPE, Proc. U. S. N. M., XXXI, 1906, p. 482.

Scorpænopsis cirrhosa SNYDER, Proc. U. S. N. M., XLII, 1912, p. 428 (not of Thunberg).

One specimen obtained at Kagoshima Bay (Wakiya).

In Japan this species has only been taken at Kagoshima. Smith and Pope and Snyder err in regarding this species as identical with the very different *S. cirrhosa.* We have compared this topotypic example of *S. kagoshimana* with a specimen of *S. gibbosa* from Samoa, and with the figures of the species, and find no basis for specific distinction. Especially diagnostic is the coloration of the under surface of the pectoral fin, clear white, with black spots in base, gray mesially, then broadly and regularly black within the narrow white margin.

The Hawaiian species *Scorpænopsis catocala* has been regarded as identical with *S. gibbosa,* but probably in error. The spines are much sharper, the cavities of the head are deeper, and the coloration is different, especially on the under surface of the pectoral fin; the base highly mottled, followed *dorsally* first by a large black blotch, then by a white area, then by a row of black spots parallel with, but well removed from, the margin of the fin; the pale margin of the ventral fins is wider. In these respects *S. catocala* agrees better with *S. diabolus,* as described and figured by Bleeker. We hesitate, however, to make the identification.

409. [722] **Pterois lunulata** Temminck and Schlegel.

Mino-kasago = Rain-coat Kasago.

Mikawa Bay (M. Ishikawa); Misaki (Aoki).

Genus BRACHIRUS Swainson.

The name *Brachirus,* occurring several pages earlier in Swainson's work (p. 71) must replace *Dendrochirus* (p. 180).

410. [723 and 725] **Brachirus jordani** (Regan).

Seto-mino-kasago = Channel Mino-kasago.

Pterois jordani REGAN, Ann. Mag. Nat. Hist., (7) XV, 1905, p. 20.

Dendrochirus jordani SNYDER, Proc. U. S. N. M., XLII, 1912, p. 428.

Ebosia starksi FRANZ, Abh. Bayer, Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 72, pl. 9, fig. 69.

One specimen secured by Wakiya in Kagoshima Bay.

Franz's description of *Ebosia starksi* agrees with *Brachirus jordani* in all details, except the number of anal soft rays, given as nine; probably a misprint.

411. [723A] **Brachirus bellus** Jordan and Hubbs, sp. nov.

(Plate X; fig. 3.)

Type 64 mm. long to caudal fin, 90 mm. long to end of caudal; collected at Misaki, Japan, by Aoki; C. M. Cat. Fishes No. 7894. No other specimen has been seen.

Dorsal rays, XII, I, 9; anal, III, 5; caudal, 12 (10 branched); pectorals. 1+7+9=17.

Head, 2.4; depth, 2.5 in standard length. Least depth of caudal peduncle, 3.5 in head, just equal to length of orbit; interorbital, 7.6; snout, 3.9; least suborbital width, 8.0; length of upper jaw, 2.5.

The ovate form of the body and the contours of the head are well shown by the artist. When viewed from in front, the head is widest at the preopercular angle; the interorbital deeply concave, with a fine groove between the two submedian ridges, which do not end in spines; no nasal spines; only two blunt spines on upper posterior margin of orbit; infraorbital keel complete, but spineless, extending to the preopercular margin opposite the uppermost and strongest (though weak) preopercular spine; the two additional preopercular spines blunt; opercles devoid of developed ridges or spines; a series of three short ridges ending in blunt spines from eye to below origin of lateral line; occipital ridges moderately elevated and sharp, widely divergent, their weak terminal spines being more than twice as far apart as their origins; a small spine on each side between occipital ridge and orbit. The two suborbital, one nasal, and one supraorbital leaf-like flaps are well drawn by the artist. The teeth are all small and blunt, arranged in moderate bands on jaws and vomer, absent on palatines. The scales of the head are cycloid, rather loosely covering the top of the head forward to middle of interorbital groove, but are well imbricate on opercle, subopercle, and the cheeks above and below the stay; sides and front of interorbital, snout, preorbital, suborbital, both jaws, interopercle, and gular and branchiostegal membranes devoid of scales. The body-scales are ctenoid, rather regularly arranged, without accessory scales, and of rather large size, there being only about twenty-eight along the lateral line to caudal base.

The form of the fins is shown in accurate detail by the artist, so that a description would add nothing not evident from an examination of the figure.

The body and fins are prettily spotted with brown or black, as pictured.

412. [724] **Ebosia bleekeri** (Döderlein). *Eboshi-kasago* = Helmet-Kasago.

A female specimen, without the elevated occipital crest, which features the male of this species, was taken at Misaki by Aoki.

413. [727, 728] **Minous monodactylus** (Bloch and Schneider).
Hime-Okoze = Princess-Okoze, or Stinging Fish.

Scorpæna monodactyla Bloch and Schneider, Ichth., 1801, p. 194.

Minous monodactylus Cuvier and Valenciennes, Hist. Nat. Poiss., IV, 1829, p. 424, pl. 95, fig. 2.—Günther, Cat. Fishes Brit. Mus., II, 1860, p. 148 (with synonymy).—Bleeker, Acad. Sci. Roy. Amst., 1876, p. 64 (with synonymy). —Jordan and Thompson, Ann. Car. Mus., VI, 1914, p. 276, fig. 47.

Minous adamsii Richardson, Voy. Samarang, Fishes, 1850, p.7.—Jordan and Starks, Proc. U. S. N. M., XXVII, 1904, p. 151.

Minous echigonius Jordan and Starks, *l. c.*, p. 153, fig. 14.

Lysoderma satsumæ Smith and Pope, Proc. U. S. N. M., XXXI, 1906, p. 484, fig. 7.

Kobe market (Jordan); Toba market (Jordan and Yamamoto); Fukui (Nonaka).

We find no characters, by which we can distinguish the Japanese and Chinese *M. adamsii* from the East Indian *monodactylus.* Regan states that he has found no difference between Japanese and East Indian material. *Minous echigonius* seems to be likewise identical, and *Lysoderma satsumæ* is doubtless based on a specimen of *Minous monodactylus,* which had lost its three semi-free anterior dorsal spines, as the type and only known specimen of that nominal species, as described and figured, otherwise agrees to minute details with normal specimens. There is no difference in scales nor in the character of the anal spines, features imperfectly described by authors other than Smith and Pope.

414. [731] **Erosa erosa** (Langsdorf). *Daruma-okoze* = Daruma-Stinger.

Kagoshima Bay (Wakiya); Misaki (Aoki). Rare.

415. [732] **Inimicus japonicus** (Cuvier and Valenciennes).
Oni-okoze = Devil-Stinger.

Tokyo, Yokohama, and Osaka markets (Jordan); Mikawa Bay (Ishikawa); Misaki (Aoki); Fukui (Nonaka). Common in the markets southward. All of the specimens taken belong to the dark-colored inshore form (typical *japonicus*).

Genus Hypodytes Gistel.

The name *Hypodytes* Gistel (1849) should replace the later *Paracentropogon.*

416. [735] **Hypodytes rubripinnis** (Temminck and Schlegel).
Ha-okose = Chief-okose.

Kochi (Wakiya); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Toyama (Yoshizawa). Very common southward.

Family HEXAGRAMMIDÆ.

417. [740] **Hexagrammos otakii** Jordan and Starks. *Ainame*; *Abura-koi* = Fat fish.

Hexagrammos aburaco Jordan and Starks, Proc. U. S. N. M., XXVI, 1903, p. 1008, fig. 1.

Sapporo market (Majima); Otaru market (Takayasu); Tokyo market (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa). Generally common especially northward.

We find that the characters supposed to distinguish *H. aburaco* from *H. otakii* do not hold; indeed, as Snyder has noted, the fifth lateral line of one side may not meet its fellow (*aburaco*), which in contrast is continued forward as the median line of the breast (*otakii*). The fourth line ends at any place between the base of the ventral fins and a point midway between the tip of the ventrals and the anus.

418. [744] **Pleurogrammus azonus** Jordan and Metz.

Pleurogrammus monopterygius Berg, Pisc. Mar. Orient., 1904, p. 71.—Tanaka, Annot. Zoöl. Jap., 6, 1908, p. 240.

Pleurogrammus azonus Jordan and Metz, Ann. Car. Mus., VI, 1913, p. 47, pl. VIII, fig. 2 (Korea).

Sapporo market (Majima); Otaru market (Takayasu).

A ripe female is 365 mm. long; other specimens are larger.

Dorsal rays XXI, 28; anal, 26 (last double); depth 4.35 to 4.65; body with indefinite cross-mottlings, as shown in the figure of the type, though denied in the description of the type.

Records of *Pleurogrammus monopterygius* from the fauna of the Japan Sea doubtless refer to the species under consideration. This Alaskan species should hence be eliminated from lists of Japanese fishes.

419. [745] **Agrammus agrammus** (Temminck and Schlegel). *Kujime.*

Misaki (Aoki); Toba market (Jordan and Yamamoto); Nagoya market (Jordan); Mikawa Bay (Ishikawa); Toyama (Yoshizawa). Not common.

Family ERILEPIDÆ.

420. [746] **Erilepis zonifer** (Lockington). *Aburabozu* = Fat priest.

Shizuoka (Jordan).

Not common, reaches a weight of 40 pounds, or more.

Family COTTIDÆ.

421. [761] **Dasycottus japonicus** Tanaka.

Dasycottus setiger JORDAN, TANAKA, and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 263 (Niigata). (Not of Bean.)

Dasycottus japonicus TANAKA, Fig. Desc. Fishes Japan, XVIII, 1914, p. 308, pl. 83, fig. 280 (Niigata).

Noo; Fukui (Nonaka). Another specimen, from Nagaoka, Japan, was sent to Stanford University by Nakamina several years ago.

Dorsal rays VIII (not XI as given by Tanaka)–12 to 14 (counting the last ray as a double one); anal, 12 or 13; pectoral 23 to 25.

On comparison of material representing *D. japonicus* and *D. setiger* we find that the differences in the form of the body and the curvature of the upper preopercular spine, used by Tanaka, do not hold. The Japanese species differs, however, having the filaments on the head fewer and more scattered, and the maxillary longer, reaching to below the posterior margin of the orbit.

422. [762] **Trachidermus fasciatus** Heckel. *Suji-kagi-kazika* = String-hook Sculpin.

A specimen from Fukuoka (Hamada) has only seven simple rays in the pectoral fin. The University of Michigan has lately received this species from Soo-chow, China.

423. [763 and 769] **Rheopresbe kazika** (Jordan and Starks).

Takitaro = Cascade-fish; *Kamakiri* = Mantis-fish.

Cottus kazika JORDAN and STARKS, Proc. U. S. N. M., XXVII, 1904, p. 265, fig. 15 (Niigata).

Rheopresbe fujiyamæ JORDAN and STARKS, Proc. U. S. N. M., XXVII, 1904, p. 270, fig. 16 (Odawara).—TANAKA, Fig. Desc. Fishes Japan, VII, 1912, p. 112, pl. 28, figs. 110–111; pl. 29, figs. 115–116.

One specimen collected at Hamada (Wakiya).

We find that *Cottus kazika* and *Rheopresbe fujiyamæ* are respectively the young and adult of the same species. In the largest paratype of *kazika*, as in our specimen, the pectoral rays are already well branched; the type of *fujiyamæ*, shows clear evidence of having been prickly; it has eight dorsal spines, and the two dorsals are in close contact. The fact that the type of *R. fujiyamæ* is a very large female, distended with eggs, accounts for the abdomen being longer than in smaller immature specimens.

424. [764] **Cottus pollux** Günther. *Kazika* = Sculpin, Miller's Thumb.

Lake Biwa (Jordan); Nagano (Nakano); Himeji (Abe); Kamishibi near Fukui.

The fin-rays vary considerably, both individually and geographically, but we are unable to refer our material to more than one species. Dorsal, VIII to X–16 to 18; anal, 11 to 13; pectoral, 12 to 16; ventral, I, 3 or 4.

425. [774] **Myoxocephalus raninus** Jordan and Starks.
Gisu-kazika = Gisu-Sculpin; *Gomo-kazika* = Trifling Sculpin.

Otaru market (Takayasu); Coast of Rikuchu (Awaya).

Our smaller specimen is closely like the type; the larger (29.5 cm. long to caudal fin) likewise agrees, except in having a smaller eye (8.6 in head).

426. [783] **Ainocottus ensiger** Jordan and Starks. *Yari-kazika* = Spear-sculpin.

Ainocottus ensiger Jordan and Starks, Proc. U. S. N. M., XXVII, 1904, p. 283, fig. 23 (Hakodate).

Ainocottus fasciatus Pavlenko, Kazani, Trd. Obsch., XLII, 1910, p. 30.

Kushiro and Nemuro (Tanaka).

Pavlenko's English diagnosis of his *A. fasciatus* contains nothing to indicate that *A. fasciatus* differs from *A. ensiger.*

Dorsal rays, IX or X–12 to 15; anal, 10 to 13; pectorals, 18; ventrals, I, 3; pores, 38 or 39; second preopercular spine, on one side of one specimen, flattened and bifid; head, 2.2 to 2.3; orbit 4.9 to 5.6; interorbital, 6.4 to 7.4; snout 3.6 (given as 2.4 in description of type, obviously an error).

The specimen from Kushiro is a nuptial male and differs widely from the females, which have hitherto been the only sex described. The lower sides are marked by brilliantly white blotches, as large as, or smaller than, the pupil; the ventral fins are black, crossed by four white bands, one basal and one terminal, the general color being that of the species of *Megalocottus.* The nasal spine is larger and doubled; the tubercles of the head are coarser and the spines are more elevated and broken, slightly approaching those of the marine "*Oncocottus.*" In addition to clusters of tubercular prickles above and below the lateral line, which are also present in the female, there is developed just above the lateral line an irregular row of cup-shaped scales, which are armed around the posterior border by a few strong spines. Pectoral rays 3 to 10 (counting from top) are armed along inner edge, except toward base, by very long strong spines; the width of a ray, including the spines, is about one-fifth of the large orbit.

427. [786] **Cottunculus brephocephalus** Jordan and Starks.

Bozu-kazika = Priest Sculpin (with allusion to the shaven head).

Cottunculus brephocephalus JORDAN and STARKS, Proc. U. S. N. M., XXVI, 1903, p. 689, fig.; XXVII, 1904, p. 289, fig. 25 (Suruga Bay).—TANAKA, Figs. Desc. Fishes Japan, XI, 1913, p. 187, pl. 51, figs. 195 and 196.

Two adults from Misaki (Aoki).

Dorsal rays, VI, 17; anal, 13. Head, 2.4; depth, 3.1, the back more elevated than in the two specimens heretofore recorded. Color brown, becoming pale about nape and dorsal fin, but elsewhere only very indistinctly marked with lighter.

428. [788] **Gymnocanthus intermedius** (Temminck and Schlegel).

Aokazika = Green Sculpin.

Takashima market (Takayasu).

Dorsal rays, X, 13 or 14; anal, 15.

429. [789] **Gymnocanthus herzensteini** Jordan and Starks.

Tsumaguro-kazika = Finger Sculpin.

Kushiro and Nemuro (Tanaka).

Dorsal, XI or X–15 or 16; anal, 17; pores 40 or 45; preopercular spine with four antler-like hooks above, those most anterior small on one side of one specimen; the tip of the spine proper bifid on one side only; the two most posterior hooks are imperfectly divided in one specimen, the posterior one directed upward along the side of the anterior one on one side, but directly backward on the other side, so as to be overlapped by the tip of the spine proper. Head, 2.8 or 3.0 in length; orbit, 4.2 or 4.3 in head; interorbital, 10.7 or 11.4; snout, 3.7 or 3.9; upper jaw, 2.3.

430. [792] **Cottiusculus gonez** Schmidt.

Toyama (Yoshizawa); Fukui (Nonaka).

The fish described and figured by Pavlenko (1910) as "*Blennicottus globiceps* var. *bryosus*" from the Bay of Peter the Great on the Asiatic mainland is utterly unlike *Blennicottus globiceps*. It may be *Cottiusculus gonez*, or a related and perhaps undescribed species.

Two of our eight specimens from the Sea of Japan have the nasal spines double and thus agree with the types of *C. schmidti* from Matsushima Bay, which consistently show this character, but do not differ in any other appreciable way. The statement that the gill-membranes of *C. schmidti* do not form a wide fold is not true, the error arising from the fact that all of the types had the head greatly distorted in preservation. We await the collection of more material from the east coast of Japan before passing on the validity of *C. schmidti.*

Dorsal soft rays, 10 to 12; anal rays, 9 to 12.

431. [795 and 806] **Alcichthys alcicornis** (Herzenstein). *Nizi-kazika* = Sham Sculpin.

Bero zanclus Snyder, Proc. U. S. N. M., XL, 1911, p. 540; XLII, 1912, pl. 56, fig. 2.

Otaru market (Takayasu); Noo; Nemuro (Tanaka).

Bero zanclus is based on a half-grown specimen of this species, in which the preopercular spine had not yet developed the flat process on its posterior edge. With age this added spine breaks up into two, or occasionally as many as six separate points.

In twelve specimens the fin-rays vary as follows: dorsal, IX or X–14 or 15; anal, 13 or 14 (the last ray doubled in both fins); pectorals, 15 to 17. Pores in lateral line, 35 to 38. Head, 2.6 to 2.8; depth, 4.9 to 5.4, about equal to greatest width of body; orbit, 4.3 to 4.6; bony interorbital width, 14.5 to 17; snout, 3.75 to 4.0; upper jaw, 2.0 to 2.1; least depth of caudal peduncle, 5.1 to 5.7.

The color-pattern may consist solely of bars cut by half circles of the ground-color, or of bars plus numerous rounded whitish spots chiefly developed below the lateral line.

Genus Furcina Jordan and Starks.

Furcina Jordan and Starks, Proc. U. S. N. M., XXVII, 1904, p. 303.

Ventral rays I, 2; body smooth, except for a few prickles along the lateral line anteriorly, and between these and the pectoral fin; penis trilobate, as in *Pseudoblennius*; teeth in bands in jaws, vomer, and palatines; preopercular spines four, the first strong, turned upward, forked, the second well developed and sharp, near the base of first, the third rudimentary or obsolete, the fourth very small, turned downward; a fringed flap on upper orbital rim, and a simple or slightly divided flap at nape.

432. [796] **Furcina ishikawæ** Jordan and Starks.

433. [797] **Furcina osimæ** Jordan and Starks.

This species differs widely from the type-species in having the first preopercular spine widely forked, instead of very narrowly divided at tip (or, rarely, even simple); the second preopercular spine shorter and weaker, not turned upward, smaller, instead of larger, than either fork of the first spine; the fin-rays fewer, 16 or 17 in the second dorsal, instead of 18 to 20, and 13 or 14, rather than 16 or 17, in the anal fin (in each case the last ray was counted as doubled).

Neither species of *Furcina* is represented in the present collection.

434. [800] **Pseudoblennius percoides** Günther. *Anahaze* = Hole Goby.

Tatoku Island (Mikimoto); Mikawa Bay (M. Ishikawa); Misaki (Aoki). Common southward.

435. [801] **Pseudoblennius japonicus** Steindachner.

Toba (Jordan and Yamamoto); Mikawa Bay (Ishikawa); Misaki (Aoki).

436. [807] **Vellitor centropomus** (Richardson). *Sui* = Fop.

Misaki (Aoki). Common at times about Misaki and southward, remarkable for its slender, pointed head, unlike that of other Sculpins.

Family PARABEMBRADIDÆ.

Genus Parabembras Bleeker.

The genus *Parabembras*, which appears to be the sole member of a sharply distinguished family, has never been adequately characterized. It differs trenchantly from *Bembras* and other Bembrids in retaining the three strong anal spines, which are characteristic of the *Scorpænidæ* in general, also distinct nasal spines, and a more extensive squamation of the head. It is specialized in the development of two spines at the front of the second dorsal fin, which is completely separated from the first.

The *Parabembradidæ* are essentially intermediate between the *Scorpænidæ* and the *Bembradidæ*.

437. [823] **Parabembras curtus** (Temminck and Schlegel).
Uba-goshi = Nurse-kochi.

A single specimen was found in the Osaka market (Jordan).

Dorsal, IX–II, 7; anal, III, 5; pectoral, 22; ventrals, I, 5; caudal, 16 (15 branched); pores in lateral line to base of caudal 37; scale-rows, 4–37–8. Head, 2.4; depth, 5.15 in length to caudal. Orbit, 3.7; interorbital, 16; snout, 3.9; upper jaw, 2.95; least depth of caudal peduncle, 4.35 in head from tip of snout to end of long opercular membrane. The dorsal contour rises in a very gently concave curve from the tip of the sharply pointed snout to the origin of the dorsal, the curve being barely broken by the premaxillary processes; the contour is then concave between the origins of the two dorsal fins, and from the origin of the second dorsal to the upper edge of the deep compressed caudal peduncle; the ventral profile is a gentle curve from the tip of the strongly projecting mandible to the caudal fin. The width and depth of body are about equal at base of pectorals, but behind this point the body becomes more and more compressed, while before this point the head becomes flatter toward the greatly depressed snout, which is only half as high as wide at front of orbit. Orbit directed upward more than outward. As viewed from above the margin of the snout forms an arch wider than a semicircle, evenly rounded, except at the truncate tip, and broken posteriorly by two very long strong spines, of which the posterior is the lower. The suborbital ridge forms a wing-like edge, armed with three or four huge, sharp-edged spines in line with the even larger spine at the preopercular angle; above the spine the preopercular margin is weakly concave, below the spine it is strongly convex and entirely smooth; the interopercle, but not the preopercle, ends in a spine; the two faint diverging opercular ridges end in weak spines, the upper the longer and the stronger; the nasal spines are closely approximate and not strong; the edge of the flattish interorbital is armed with six moderately elevated spines, not counting one in the front and two on the posterior orbital margin; of the latter two the lower is near the anterior end of a ridge, which ends in a single or double spine at the upper end of the preopercular margin; the parietal spine is weak, terminating a very faint ridge; a ridge borders the lower edge of the acute scapular process and ends in a strong spine; behind this a few of the most anterior scales of the lateral line are weakly armed. Opercular region flattish; viewed from in front the head is hexagonal in outline, with the dorsal and lateral margins about twice as wide as the two lateral faces of each side. Maxillary extending to below front of pupil; its upper edge ensheathed by the sharp lower edge of the narrow suborbital; its posterior margin strongly emarginate, with the lower angle produced ventrad and mesad as a rounded lobe. The minute teeth form moderate bands on the jaws; posteriorly the entire premaxillary, anteriorly the entire mandibular band, are exposed; the vomerine teeth form two narrow lobes widely divergent from a common base at front of vomer; the palatine teeth, also small, are on a greatly elongate, elevated ridge, ending anteriorly opposite the posterior ends of the vomerine band. The gill-opening is free to below front of orbit; seven branchiostegals; shoulder-girdle forming a sharp bony ridge; slit behind last gill-arch not as wide as pupil; gill-rakers 6+11, counting a few rudiments above and below. Dorsal spines strong, diverging at wide angles anteriorly; first dorsal evenly rounded in both directions from the fifth spine, which is contained 2.6 times in the head; both first and last spines small. Dorsals separated by an interspace about half as long as orbit. First spine of second dorsal strong and nearly as long as the first and longest soft ray (which is branched), longer and much heavier than the second spine, contained 3.25 times in the head. Anal spines strong and divergent, when depressed; second anal spine more than twice as long as the first, longer than the third (and also stronger), about two-thirds as long as the second, or first branched ray of the five soft rays, and contained 4.6 times in the head. Pectoral reaching to above anus, its length being contained 1.65 times in head; its lower margin nearly parallel with, and about half as long as, upper, when the fin is not stretched; lower rays simple, but not stronger, thickened, nor detached. Ventral fin lying flat and horizontal along the lower pectoral margin; the moderately strong spine is contained 1.8 times in total length of the fin, which measures 2.2 times in head; the fin does not reach the anus, which is in advance of anal fin a distance contained 2.2 times in orbit; base of ventral a little in advance of that of the pectoral, as in *Bembras.* The caudal fin very slightly and symmetrically rounded. Scales large, evenly arranged, and rounded, their margins very weakly ctenoid. On the head the scales extend forward dorsally to the nostrils, being uniserially arranged along the interorbital laterally to the orbit, and ventrally to below the end of the maxillary. Lateral line nearly straight from its origin at upper end of gill-opening to the middle of caudal peduncle, thence between the seventh ray from the bottom and the ninth from the top, to the end of the caudal fin.

Body pale amber-color, with dark scale-margins dorsally, but otherwise unmarked; fins whitish.

Pyloric cæca present. Eggs minute. No air-bladder.

Family BEMBRADIDÆ.

In our opinion the *Bembradidæ,* which are intimately connected with the *Scorpænidæ* through the *Parabembridæ,* represent a family distinct from, and possibly not even directly related to, the still more aberrant *Platycephalidæ.* We cannot therefore agree with Regan,[113] who has united the two groups.

438. [821] **Bembras japonicus** Cuvier and Valenciennes. *Aka-gochi* = Red Kochi.

Osaka market (Jordan); Kochi (Wakiya); Misaki (Aoki).

We here give a re-description of this rare species: Dorsal, XI, I, 11; anal, 14; pectoral, 17; ventral, I, 5; caudal, 14 (12 branched); pores 55 in lateral line, slightly fewer than the number of oblique scale-rows. Head, 2.9; depth, about 8 in length to caudal. Orbit, 4.0; interorbital, 15.0; snout, 2.9; upper jaw, 2.6; least depth of caudal peduncle, 6.5 in head. Tip of snout sharp, the premaxillary and its process entering the dorsal contour, which from behind the process ascends in a gentle curve (broken only by the superorbital serrations and the parietal spine) to origin of dorsal, from which it descends gradually to the moderately attenuate caudal peduncle; ventral contour nearly straight. Head slightly depressed, its length at occiput 1.2 in the greatest width, its depth opposite front of orbit 1.3 in width at the same vertical; orbit directed equally outward and upward. No nasal spines; snout subspatulate when viewed from above, the sharp lateral margin of preorbital with three spines increasing in strength backward, the last concealing the upper edge of the maxillary; the sharp suborbital stay also entering the lateral profile, armed by four long spines directed backward, the first two below the margin of the pupil, the third below posterior orbital rim, and the fourth at front of preopercle; strongest preopercular spine in line with these suborbital spines, its length measured from front of preopercle two-fifths that of eye; two somewhat smaller and flatter spines directly below the strongest one; from the lower of these two the preopercular margin, armed by one or two obtuse angles, curves abruptly forward; one interopercular, one preopercular, and two opercular spines, forming a series increasing in strength upward; two strong opercular spines terminating two keeled ridges arising together near front of opercle, a strong spine on front of orbit, and seven to ten oblique serrations along the parallel sides of the deeply concave, three-grooved interorbital; a ridge from eye to upper edge of preopercle terminating in a spine followed by a similar spine; three ridges converging to spiny tips at origin of lateral line; the five anterior scales of the lateral line bearing spined keels; top of snout ridged; opercular region and cheeks below the suborbital ridge tumid; maxillary extending a little beyond the front margin of orbit; its wide posterior edge emarginate; jaws about equal anteriorly, but the mandibles narrower than the snout, so that the band of premaxillary teeth is almost entirely exposed in ventral aspect; outermost premaxillary teeth slightly enlarged; mandibular teeth somewhat smaller and in a narrower band than those on the premaxillary; vomerine teeth small, in two widely divergent bands connected anteriorly by a narrow half-ring of teeth; palatine teeth similar, on a very narrow, sharply elevated, and greatly elongate ridge; no mandibular barbel; gill-opening extending forward to below end of gape; seven branchiostegals; edge of shoulder-girdle with an oblique bony ridge; last gill-slit about as wide as pupil; gill-rakers slender at angle, 1+9 in number, not counting bare rudiments, which do not grade into the developed raker. No pyloric cœca. Dorsal spines heteracanthous, but not widely divergent, high, the first 3.5 the third and highest 2.2 in head, the others graduated to the last, which is well separated by membrane from the first soft ray; spine at front of second dorsal, 4.9 in head; caudal barely emarginate, the upper edge longer than the lower. Pectoral with a produced lobe and a rounded lower margin, composed of seventeen rays, of which the lower five are unbranched and somewhat thickened distally; ventral fins lying flat and horizontal against the body next to the lower edge of the peduncle, and curved, not reaching the anus; base of ventrals a little in advance of that of pectorals; length of pectoral, 1.7 of ventral, 2.0 in head. Anus close to anal fin. Scales sharply ctenoid, on the head extending forward only to the orbit, covering all of the opercles, excepting the preopercular rim and the cheeks below the suborbital stay.

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[113] Regan, Ann. Mag. Nat. Hist. (8) XI, 1913, pp. 171, 177.

Body pale yellow, with a trace of a darker lateral streak; the upper sides anteriorly and the lateral line are marked with blackish spots; dorsal fins marked with round black spots; anal clear in one specimen, but in another with a black blotch at the base of each interradial membrane; pectoral streaked with brown medially; caudal with upper edge dark and with a broad subterminal bar rounded off ventrally and there intensified to form a large and conspicuous black spot. Young, 10.5 cm. long, have the color-markings more intense, the black spots generally distributed over the upper two-thirds of the body and head, becoming faint on the snout; a dark cross-shade under the middle of each dorsal fin, and at the base of the caudal; spinous dorsal with a large dark blotch on its anterior half, while the posterior half is spotted like the second dorsal; anal and ventrals immaculate; the caudal, in addition to the markings described for the adult, with two darker spots near base and a black spot on lower margin; pectoral banded with brown spots above, and heavily marked with black dashes ventrally, the lowest two rays clear. Lateral line spiny at front, running not far above middle of sides of body, but rather high on front of caudal peduncle; then near base of caudal bent downward, and running out to end of caudal along upper edge of the fifth main caudal ray as counted from the lower edge of the fin.

Family PLATYCEPHALIDÆ.

KEY TO JAPANESE GENERA OF PLATYCEPHALIDÆ.

a. Head moderately depressed, with strong ridges and high sharp spines; only one enlarged spine on preopercular margin; vomerine teeth in two parallel longitudinal bands[114]; palatine teeth in a band.

  b. (*Onigociinæ* subfam. nov.) Preopercle without an antrorse spine.

    c. Side of head unicarinate; infraorbital ridge armed by close-set serrations; a rather strong antrorse spine on preorbital margin; orbit with a developed cirrhus; scales large, the pores in the lateral line fewer than 40.

      d. Scales of lateral line with weak basal keels anteriorly, but everywhere without spines; antorbital margin without small serrations, armed by a single spine; posterior half only of superciliary ridge serrate; ventral fins of moderate length, not extended to origin of anal. *Onigocia*[115] (*macrolepis*).

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[114] The two bands are joined together anteriorly (as an abnormal variation ?) in one specimen of *Inegocia japonica*).

[115] Jordan and Thompson, Proc. U. S. N. M., XLVI, 1913, p. 70.

dd. Scales of lateral line strongly spined anteriorly, weakly spined posteriorly; antorbital margin with serrations in addition to a strong spine; entire length of superciliary ridge serrate; ventral fins elongate, reaching beyond anal .... *Wakiyus*[116] (*spinosus*).

cc. (*Inegociinæ*, subfam. nov.) Side of head bicarinate; infraorbital ridge armed by well-spaced serrations; no strengthened antrorse spine on preorbital; orbit without a cirrhus; scales of moderate to small size. Scales of lateral line largely smooth, becoming weakly spined toward the head.

e. All minor ridges of head denticulate or granulate; lowermost of the three preopercular spines strong, and persistent at all ages. Teeth villiform, non-depressible, in narrow bands; infraorbital ridge with four to six scarcely differentiated spines between preorbital and preopercular spines; a well defined ridge between orbit and occiput; inner edge of premaxillary produced inward and backward as a thick inflexible lobe; opercular margin with a membranous flap below preopercular spines; no orbital cirrhus.
Insidiator[117] (*meerdervoorti*).

ee. Ridges of head devoid of fine denticulations or granulations; lowermost of the three preopercular spines small, becoming obsolete with age.

f. Teeth villiform, little specialized, becoming granular with age (especially in *Inegocia*); infra ridge with but two spines behind one on preorbital, the second turned upward; a well-defined ridge between orbit and occiput; inner edge of premaxillary dilated inward and backward as a thick inflexible lobe.

g. Opercular margin with a membranous flap below preopercular spines; spine near center of preorbital obsolete (very rarely developed on one side); main preopercular spine short, about one-third as long as orbit, or shorter; twelve soft rays in dorsal and anal.
Inegocia[118] (*japonica*).

gg. Opercular margin without a membranous flap; a sharp spine constantly present on preorbital; main preopercular spine of moderate length, about two-fifths as long as orbit; eleven rays in dorsal and anal .... *Cocius*[119] (*crocodilus*).

ff. Teeth highly specialized, resembling those of a *Synodus*; those of upper jaw canine-like and depressible in a wide lobe anteriorly, minute and granular, except on innermost row on sides of jaws; vomerine teeth few, enlarged, very sharp and depressible; palatine teeth sharp, enlarged, and depressible along innermost row; infraorbital ridge with numerous differentiated spines, one on preorbital, two below front of eye (the posterior one enlarged), three below posterior part of orbit, the last very strong, and turned upward, and followed by three small spines; no continuous ridge from orbit to occiput; inner edge of premaxillary expanded inward, but not backward, as a thin and flexible lobe.
Ratabulus[120] (*megacephalus*).

bb. (*Rogadiinæ* subfam. nov.) Preopercle with a very strong antrorse spine on lower margin; orbit without cirrhus; ridges of head armed by close-set serrations or granulations; sides of head unicarinate; opercular margin without membranous flap .... *Rogadius* (*asper*).

aa. (*Platycephalinæ*). Head greatly depressed, with feeble ridges and spines; two enlarged spines on preopercular margin; vomerine teeth in a transverse bilobed band; palatine teeth uniserial; opercular margin with a membranous flap .... *Platycephalus* (*indicus*).

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[116] Jordan and Hubbs, new genus (Type: *Platycephalus spinosus* Temminck and Schlegel).

[117] Jordan and Snyder, Proc. U. S. N. M., XXIII, 1900, p. 368.

[118] Jordan and Thompson, *loc. cit.*, p. 70.

[119] *Cocius* Jordan and Hubbs, new genus; Orthotype, *Platycephalus crocodilus* Tilesius.

[120] *Ratabulus* Jordan and Hubbs, new genus; Orthotype, *Thysanophrys megacephalus* Tanaka.

439. [816] **Onigocia macrolepis** (Bleeker).
Anesagochi = Elder Kochi; *Onigochi* = Devil Kochi.

Misaki (Aoki).

440. [815] **Wakiyus spinosus** (Temminck and Schlegel).

This is the only Japanese species of the family not represented in the present collection. We have examined material previously recorded.

441. [818] **Insidiator meerdervoorti** (Bleeker). *Megochi* = Big-eye Kochi.

Wakanoura (Yamamoto); Toba market (Jordan and Yamamoto); Kobe and Yokohama markets (Jordan); Mikawa Bay (Ishikawa); Toyama (Yoshizawa); Miyazu, Noo.

Dorsal soft rays, 10 to 12, usually 11; anal, 11.

The closely related *Insidiator detrusus* represents this species on the Chinese coast. We have re-examined the type of that species.

442. [817] **Inegocia japonica** (Tilesius). *Tokage-kochi* = Lizard Kochi.

Wakanoura (Yamamoto); Tokyo and Kobe markets (Jordan); Kagoshima Bay (Wakiya); Misaki (Aoki); Miyazu.

443. [819] **Cocius crocodilus** (Tilesius). *Inegochi* = Rice Kochi.

Tokyo and Kobe markets (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (Ishikawa); Fukuoka (Hamada); Miyazu; Noo.

444. **Ratabulus megacephalus** (Tanaka). *Haname-gochi* = Flower-eye Kochi.

Kagoshima Bay (Wakiya).

Mr. M. Kasawa has given us the following translation of Tanaka's original description, published in Japanese:

'Head, 2.56 in length of body without caudal fin; depth 8.5. Eye, 5.2 in head; interorbital space, 13; snout, 3; maxillary, 3.33; depth of caudal peduncle, 8.66; depth of head, 4.66; width of head, 2. Dorsal, IX–11; anal, 12; pectoral, 20, seven lower rays unbranched; caudal, 13 branched rays. Scales 71 from gill-opening to base of caudal counting downward and backward; 98 counting downward and forward; scales in transverse series 15–31 counting downward and backward, 10–23 counting downward and forward; preopercle with two spines; no tentacle on eye. Caudal fin somewhat rounded; pectoral reaching to middle of length of ventral; ventral to base of anal. Interorbital width 2.5 in diameter of eye; eye 1.75 in snout; snout 1.5 in postorbital.

Color dark gray, the head, body, dorsal, pectoral, ventral, and caudal fins with small black spots; the spots a little larger than elsewhere on the first dorsal and caudal; front margin of first dorsal with a dark blotch; margin of caudal with dark streaks (not spots); anal fin without streaks, but with a dark margin posteriorly, and a pale white margin anteriorly.

The type was found in the Tokyo market, where the species is not uncommon. Length 313 mm. from tip of snout to base of caudal. It is characterized by its long head, the proportionate width and depth of the head and the long snout.'

445. [820] **Rogadius asper** (Cuvier and Valenciennes).
Matsuba-gochi = Pine Kochi.

Kagoshima (Wakiya).

446. [814] **Platycephalus indicus** (Linnæus). *Kochi*; *Makochi* = True Kochi.

Tokyo market, Mikawa. Fukuoka, Osaka, Kobe, Yokoyama, Toba. Everywhere common in southern Japan. The largest species, constantly in the markets. We have also a specimen from Soo-chow, China, sent by Dr. Cora D. Reeves.

Family HOPLICHTHYIDÆ.

447. [824] **Hoplichthys langsdorfi** (Cuvier and Valenciennes).
Natsuhari-gochi = Summer Needle-kochi.

Kagoshima Bay (Wakiya); Misaki (Aoki).

Jordan and Thompson have given a useful analysis of the Japanese species of *Hoplichthys*.

Family TRIGLIDÆ.

448. [827] **Chelidonichthys kumu** (Lesson and Garnot). *Hobo* = Gurnard.

Tokyo and Osaka markets (Jordan); Toba (Jordan and Yamamoto); Tatoku Island (Mikimoto); Mikawa Bay (M. Ishikawa); Choshi (C. Ishikawa); Toyama (Yoshizawa); Misaki (Aoki); Miyazu.

Dorsal IX–15 or 16; anal, 14 or 15 (the last ray doubled). Interorbital width, 6.4 to 7.4 in length of head.

449 [829] **Lepidotrigla alata** (Houttuyn). *Hoderi* = Gurnard.

Tokyo, Shizuoka, and Osaka markets (Jordan).

Dorsal, IX, 15 or 16; (last branched); scales of lateral line 60.

Inner surface of pectoral fin violet blackish, except on the uppermost and three lowermost rays, which are whitish; a large lemon-yellow blotch medially.

A ripe female is 163 mm. long to caudal.

450. [830] **Lepidotrigla güntheri** Hilgendorf. *Kanado.*

Misaki (Aoki); Tokyo market (Jordan); Toyama (S. Yoshizawa); Fukui.

Dorsal, VIII–15; anal, 14 (rarely) or 15 (the last ray as double); the last dorsal spine very small in one specimen. Inner surface of pectoral fin red at base, yellowish on the first upper and lowermost three rays, dusky or olive elsewhere, becoming blotched dorsally and inky black, with fewer or more bright blue streaks, ventrally.

Young, about 6 cm. long to caudal, have the head rougher, with stronger spines, but show the specific characters as well as do the adults. They show an irregular double dark band under each dorsal fin, and a basal and broader subterminal band on the caudal.

451. [832] **Lepidotrigla japonica** (Bleeker). *Toge-kanagoshira* = Thorn Gurnard.

Yokohama and Tokyo markets (Jordan); Toba (Jordan and Yamamoto); Wakanoura (Yamamoto); Kagoshima Bay (Wakiya); Mikawa Bay (M. Ishikawa). One hundred and twenty specimens in all. Very common southward.

Scales about 55 to end of last vertebra. The rostral lobes are strongly spinous in many individuals, particularly large ones. Color red in formalin, with a greenish tinge dorsally.

452. [833] **Lepidotrigla strauchi** Steindachner. *Kanagashira* = Gurnard.

Tokyo and Osaka markets (Jordan); Toba (Jordan and Yamamoto); Toyama (S. Yoshizawa); Misaki (Aoki); Miyazu.

With age the dorsal spot, black in the young, becomes faint. Inner surface of pectoral dusky, except on the first upper and lowermost three rays, which are yellow; the dusky color often becoming black on a blotch located medioventrally where the rays show bluish white spots.

453. [834] **Lepidotrigla abyssalis** Jordan and Starks.

Misaki (Aoki).

Dorsal rays, VIII, 14 or 15; anal, 14 or 15. The uppermost detached pectoral ray may not reach the ventral tip, though not falling so far short as in *L. strauchi.* The anterior profile of the snout, as seen from above, may be gently concave. Inner side of pectoral smutty black, unspotted, except on the uppermost ray and lowermost three rays.

454. [831] **Lepidotrigla kishinouyi** Snyder.

Misaki (Aoki). A single specimen agreeing well with a paratype.

Dorsal, VIII–16; anal, 16, counting the last ray as double (the paratype has VIII–16 dorsal and 15 anal rays). Inner side of pectoral fin dusky, except for the pale uppermost and lowermost three rays, becoming black in a bright blue spotted blotch ventrally.

We do not feel certain of the relationships or even the validity of this species.

Family DACTYLOPTERIDÆ.

455. [840] **Daicocus peterseni** (Nyström).

Hoshi-semi-hobo = Star Cicada-gurnard.

Misaki (Aoki).

Our eleven young specimens seem referable to this species; 52 to 76 mm. long to caudal fin.

The head is contained 2.9 to 3.1 times in the standard length; the snout, eye, and postorbital are each about equal. The body is spotted as in the adult, but is further marked with broad diffuse bars below each dorsal fin.

Family AGONIDÆ.

Key to Genera Confused with Occa.

a. Dorsal spines 7 to 10; pectoral fin narrow, rounded (with 14 or 15 rays); ventral fins of male enlarged, the rays thickened, and provided with free keel-like membranes on their outer edges; snout narrow (approaching that of *Brachyopsis*), a little wider at base than long, as measured to tip of mandible.

b. Dorsal spines 7 to 9; anal fin short, having only 10 or 11 rays;[121] ventral fins of male greatly elongate, reaching past front of anal; plates more strongly spined, those of the dorsal as well as lateral series with sharp spines; suborbital stay with a spine; vertebræ 37 .... *Occa* (*verrucosa*).

bb. Dorsal spines 9 or 10; anal fin longer, of 13 to 15 rays; ventral fins of male not very much larger than those of female, not nearly reaching anal; plates much smoother, especially toward belly and caudal base, those of the dorsal series scarcely spined; suborbital stay without a spine; vertebræ 39 .... *Ocella* (*dodecaëdron*).

aa. Dorsal spines 12 to 15; pectoral fin broad, subtruncate above (with 18 or 19 rays); ventral fins of male not enlarged, without keel-like membranes on outer edges; snout much broader than long, as measured to tip of mandible; anal rays 15 to 17.

c. Dorsal spines usually 12 (sometimes 13); suborbital stay with a sharp spine; suborbital bicarinate; frontal and parietal prominences connected by a continuous ridge; supraorbital ridge forming a shelf somewhat overhanging the surrounding groove .... *Iburina* (*iburia*).

cc. Dorsal spines thirteen to fifteen; suborbital stay spineless; suborbital unicarinate; frontal and parietal prominences entirely separated; supraorbital ridge low, not overhanging the surrounding groove .... *Iburiella* (*kasawæ*).

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[121] The last double ray counted as one as in all descriptions in this paper.

OCCELLA Jordan and Hubbs, gen. nov.

Type: *Agonus dodecaëdron* Tilesius.

This genus, and the others which follow, are defined in the key given above.

456. [846] **Occella dodecaëdron** (Tilesius). *Shachi-uwo* = Capstan-fish.

IBURINA Jordan and Hubbs, gen. nov.

Type: *Occa iburia* Jordan and Starks.

457. [847] **Iburina iburia** (Jordan and Starks).
Yori-shachi-uwo = Twisted Capstan-fish.

Neither this species, nor the preceding, of which we have material at hand, is represented in the present collection.

IBURIELLA Jordan and Hubbs, gen. nov.

Type: *Iburiella kasawæ*, sp. nov.

This genus combines certain of the characters of *Occella* and *Iburina*, with which it is compared above in the key. In the length of the spinous dorsal fin it approaches *Tilesina*, which genus we now think may be referred to the same subfamily (*Brachyopsinæ*).

458. [847A] **Iburiella kasawæ** Jordan and Hubbs, sp. nov. (Plate XI, fig. 1).

Type a fine specimen 133 mm. in length, seined by Snyder and Sindo at Tomakomai, near Mororan, Japan, in 1906. It was taken with a series of *Iburina iburia*, already recorded by Snyder.[122] The type is in the Carnegie Museum (Cat. of Fishes No. 7906). A single paratype, 85 mm. long, was collected by Tanaka at Kushiro, Hokkaido, in 1922.

Dorsal, XV (XIII)[123]–9 (8); anal, 15 (16)[123]; pectorals, 18; ventrals, I, 2; caudal 13 (counting small rays). Pores in lateral line, 43, the first twenty armed with spines. Head (from tip of snout to end of opercular membrane), 4.3 (4.0) in standard length. Greatest depth (between spines of dorsal and ventral series) 1.7 (2.4) in head; depth of caudal peduncle, 7.6 (8.0); eye, 6.0 (6.6); orbit, 5.1 (4.9) equal to snout; interorbital width, 4.1 (4.2); snout and orbit, 2.6 (2.45); width across opercles, 1.2 (1.3); width of snout at base, 2.35; upper jaw, 3.05 (3.0). Body everywhere, except near caudal base, forming in cross-section a somewhat depressed octagon with each face concave. The dorsal and the two lateral series of plates bear strong spines, which become weak on the caudal peduncle and beneath the pectoral fin; the ventral series comprises plates bearing low rounded keels, each ending in a small point. The spines of the body are marked with strong ridges, which diverge outward and backward from the spines on most of the plates, but which radiate in all directions from the prominences on the tubercles of the caudal peduncle and breast. The plates number 44 (43) in the dorsal series, the last 6 (or 7) being more or less completely joined to their fellows; 38 to 40 in the upper lateral series; 38 or 39 (36 to 39) in the lower lateral series; 36 (34) paired and 3 (4) median in the ventral series. Breast armed with large rounded flattish tubercles, one of which, median in position, is separated from each ventral fin by two or three others It is preceded by four, arranged in the form of a triangle or square, and surrounded by smaller less definite tubercles; a chain of large bucklers around the gill-opening, giving off a branch to lower end of the pectoral base; an irregular row of small tubercles crowded in between the bucklers of the two ventral series before the anal fin, but no plates surround the anus. All fleshy regions between the bony plates (on the trunk only the tail being completely armoured) covered with numerous thick-set fleshy flaps, which are in part modified into small tubercles ventrally and into small flat spines in the area covered by the pectoral fin. Head completely smooth, on all faces being largely covered with skin thickly studded with small to minute pads, most of which bear small, more or less spiny, points. The radially striate bony prominences on frontal, parietal, and cheek regions not connected with one another, the whole head being relatively free from long trenchant ridges; suborbital stay without trace of spine; superciliary ridge greatly depressed, and not dilated as a shelf over the surrounded groove; preopercle with three blunt spines, of which the uppermost is rather strong, the lowermost almost rudimentary; suborbital bearing but one keel; preorbital sculptured, with two keels directed downward and two forward, none ending in sharp spines; the strongly convergent nasal spines very weak; the striæ on almost all exposed bones and spines of head bearing fine granulations. Lower jaw hooked upward in front of upper, so that the anterior mandibular teeth are exposed, and directed backward as much as upward. Snout relatively extremely broad and short, its length from eye being narrower than interorbital space; its length along midline from opposite front of orbits only three-tenths its basal width. Gill-membranes narrowly joined, but free from isthmus; gill-rakers fleshy tubercles, 1+7 on first arch. Upper jaw when in place largely ensheathed, extending almost to below front of pupil, bearing a thin flat tentacle near its end. Teeth all weak, forming moderate bands on the jaws, a large transverse patch on the vomer, and evident on the palatines. Occipital region flattish, interorbital but weakly concave. Pectoral fin rather more sharply truncated than is indicated in the figure.

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[122] Proc. U. S. N. M., XLII, 1912, p. 436.

[123] The counts and measurements in parentheses are those of the paratype.

Body brown or slaty, colorless below; back posteriorly crossed by alternate bars of dark and light; fins marked with blackish (brown on spinous dorsal) and clear areas. In the paratype the upper outer margin of the second dorsal is blackish; the spot on the anal fin extends to the margin of the fin; the caudal is black about the lighter (though dusky) area, which is longitudinally divided into two parts.

This species is named for Mr. Masunosuke Kazawa of Sapporo, a graduate student of Stanford University, engaged in the study of the fishes of the Hokkaido.

459. [848] **Brachyopsis rostrata** (Tilesius). *Shichiro-uwo.*

A series from Kushiro, Hokkaido (Tanaka).

460. [850] **Pallasina eryngia** Jordan and Richardson. *Yagi-uwo* = Goat-fish.

Toyama, (S. Yoshizawa).

Our specimen has the barbel as remarkably long as in the types.

461. [852] **Draciscus sachi** Jordan and Snyder. *Shachi* = Capstan.

Kushiro (Tanaka); Noo.

Dorsal rays VIII or IX–14 (the last one double); anal, 16 or 17.

462. [863] **Sarritor leptorhynchus** (Gilbert).

Fukui.

Family LIPARIDÆ.

463. [895] **Crystallias matsushimæ** Jordan and Snyder. *Abachan.*

A specimen 34.5 cm. long, collected by Tanaka at Kushiro, Hokkaido, agrees in most respects with Gilbert and Burke's redescription of *Crystallias matsushimæ*,[124] but differs in the much smaller size of the head, and of the various parts of the head in reference to the total length. This difference is doubtless to be accounted for by the veritably huge size of our specimen.

Measurements in hundredths of length without caudal (34.5 cm.). Length of head, .22; diameter of eye, .04; length of snout, .085; interocular width, .095; preoral length of snout, .05; length of gill-slit, .045; distance from tip of mandible to front of disk, .07; to anus, .175; diameter of disk, .085; depth of body, .325; longest pectoral ray of upper lobe, .18; of lower lobe, .095; length of caudal, .14; length of attachment between caudal and anal, .09. A smaller specimen from the Sea of Japan, taken by Nonaka at Fukui, agrees better with the description of the type.

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[124] Proc. U. S. N. M., XLII, 1912, p. 376.

Family ECHENEIDÆ.

Genus Remorina Jordan and Evermann.

Body unusually robust, the ventral contour strongly curved; lower jaw without a produced flap; pectoral fin broadly rounded, scaly, thick and firm, especially on upper edge, but not bony; dorsal and anal fins small, the anal the longer; caudal rounded; disk unusually large, with twelve or thirteen laminæ.

464. [902] **Remorina albescens** (Temminck and Schlegel).
Shiro-koban = White Koban, or Remora.

Echeneis albescens (Temminck and Schlegel), Fauna Japonica, Pisces, 1850, p. 272, pl. CXX, fig. 3.—Günther, Cat. Fishes Brit. Mus., II, 1860, p. 377.—Jordan and Evermann, Bull. U. S. N. M., XLVII, pt. 3, 1898, p. 2272.

Echeneis clypeata Günther, Ann. Mag. Nat. Hist., (3) Vol. V, 1860, p. 401; Cat. Fishes Brit. Mus., II, 1860, p. 376.—Tanaka, Fig. Desc. Fishes Japan, XVIII, 1914, pl. 90; XIX, 1915, p. 334.

One specimen of this very distinct Echeneid was obtained by Aoki at Misaki. It is 118 mm. long to caudal fin. The body is pale, with very irregular dark markings, rather thickly set.

Genus Remoropsis Gill.

Body moderately slender, but not greatly attenuate as in *Echeneis naucrates*; lower jaw without a specialized flap; pectoral truncate, its rays flexible; dorsal and anal fins long, the dorsal especially so, having about thirty rays; caudal truncate; disk of moderate size, with about 16 (14 to 17) laminæ.

465. [903] **Remoropsis brachyptera** (Lowe). *Kuro-koban* = Black Koban.

One specimen; Misaki (Aoki), Laminæ 16.

Genus Remora Gill.

466. [904] **Remora remora** Linnæus. *Koban* = Suck-fish.

Two young specimens; Misaki (Aoki). Laminæ 17 or 18.

Family BOTHIDÆ.

Genus Scæops Jordan and Starks.

This genus seems sufficiently distinct from both *Psettina* and *Engyprosopon*, differing from the former in having the teeth biserial and from the latter in having the interorbital space greatly widened.

467. [909] **Scæops grandisquama** (Temminck and Schlegel).

Daruma-garei = Daruma[125]-flounder.

Kobe market (Jordan).

468. [910] **Psettina iijimæ** (Jordan and Starks).

Kagoshima Bay (Wakiya).

469. [911] **Læops lanceolata** Franz.

Læops lanceolata Franz, Abh. Bayer. Akad. Wiss., Vol. I, 1910, Suppl. 4, p. 62, pl. 8, fig. 60 (Fukuura; Zushi, on Sagami Bay).—Hubbs, Proc. U. S. N. M., XLVIII, 1915, p. 460.

Toba (Jordan and Yamamoto); Fukui (Nonaka).

The first two dorsal rays are separated from the rest of the fin, as in *Læops kitaharæ*[126] and *Læoptichthys fragilis.*[127]

Dorsal rays, 106 to 108; anal, 86 to 88; scales in lateral line, about 98 to 113; head, 6.25 to 6.6; depth, 2.65 to 2.8; eye, 2.9 to 3.2. The specimens agree better with the characters of *L. lanceolata* than with those of *kitaharæ* (See Hubbs, *l. c.*, p. 460), but in some respects are intermediate. It is quite probable that the two species will prove inseparable, in which case Smith and Pope's name will be used.

470. **Arnoglossus tenuis** Günther.

Arnoglossus tenuis Günther, Challenger Reports, Shore-Fishes, 1880, p. 55 (Hong Kong).

We have seventeen specimens of an *Arnoglossus* from the market at Kobe (Jordan), which are very different from the two species of the genus now known from Japan. *Arnoglossus violaceus* Franz[128] has 100 scales in the lateral line, and *Arnoglossus japonicus* Hubbs[129] has 64 scales, the teeth enlarged anteriorly, and the second dorsal ray considerably elongated. The material from Kobe we identify with *Arnoglossus tenuis* originally described by Günther from Hong Kong.

Dorsal rays, 90 to 93; anal rays, 67 to 72; head, 4.0 to 4.1; depth, 2.5 to 2.7; upper orbit, 3.1 to 3.3; upper jaw, 2.6 to 2.7; scales in the lateral line, 48 to 54.

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[125] *Daruma* is a small squat demigod.

[126] *Lambdopsetta kitaharæ* Smith and Pope, Proc. U. S. N. M., 1906, p. 496, fig. 12.—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1910, p. 317, fig. 265.—*Læops kitaharæ* Hubbs, Proc. U. S. N. M., XLVIII, 1915, p. 460.

[127] Hubbs, *l. c.*, p. 460, pl. 26, fig. 4.

[128] Abh. Bayer. Akad. Wiss., Vol. I, 1910, Suppl. 4, p. 61, pl. 7, fig. 56.

[129] Proc. U. S. N. M., XLVIII, 1915, p. 454, pl. 25, fig. 2.

Body elongate-elliptical, the gentle dorsal contour being broken only by the premaxillary processes. Lower eye in advance of upper; interorbital narrow and trenchant, its sigmoid ridge forming also the front margin of the lower orbit; nostrils in a horizontal line, the anterior one bearing a short, broadly rounded flap; jaws about equal anteriorly, the mandibular knob projecting a little; gape moderate, curved and oblique; upper jaw extending backward beyond front of lower orbit, but not to below pupil. Gill-rakers represented by one or two bare rudiments on upper limb, and by seven to nine developed ones on lower limb, the longest about one-fourth as long as orbit. Scales very deciduous, none remaining on our specimens. No color-markings, other than the dark margins of the scale-pockets. Our specimens vary in length from 37 to 62 mm.

A still smaller specimen, 27 mm. long to caudal, was found in the stomach of a *Platycephalid* taken at Kobe.

Family PARALICHTHYIDÆ.

471. [916] **Pseudorhombus oligodon** (Bleeker).

Kobe market (Jordan).

Dorsal, 74 to 78; anal, 64 to 66; pores, 85 to 88; gill-rakers, 2+8=10; head, 3.3; depth, 2.2.

472. [917] **Pseudorhombus arsius** (Buchanan Hamilton).[130]

Shizuoka (Jordan); Mikawa Bay (M. Ishikawa); Fukui (Nonaka).

Dorsal rays, 76 or 77; anal, 58 to 60; pores, 78 to 82; gill-rakers, 11 or 12 below angle; depth, 2.1 to 2.2. Body marked rather indistinctly with non-ocellated blotches, one on lateral line just behind end of arch, and sometimes another near middle of straight portion of lateral line; one near caudal base; bare traces of others above and below the lateral line. In addition to the blotches, fine black specks may be present over the body.

Our largest specimen is 268 mm. long to the caudal fin.

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473. [918] **Pseudorhombus cinnamomeus** (Temminck and Schlegel).

Ganzo-birame = False Halibut.

Pseudorhombus misakius Jordan and Starks, Proc. U. S. N. M., XXXI, 1906, p. 175, figs. 4, 5.

Tokyo (Jordan); Choshi (C. Ishikawa); Noo.

Dorsal, 81 or 82; anal, 63 or 64; pores, 80 or 83; head, 3.5 to 3.6; depth, 1.9. The dark spot on the lateral line near the end of the arch is not invariably ocellated.

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[130] See Snyder, Proc. U. S. N. M., XLII, 1912, p. 439.

474. [919] **Pseudorhombus ocellifer** Regan.

Shizuoka, Osaka, and Kobe markets (Jordan); Kagoshima Bay (Wakiya); Misaki (Aoki); Fukui (Nonaka); Toyama (Yoshizawa); Miyazu; Noo.

Dorsal rays, 71 to 77; anal, 53 to 57; pores, 64 to 73; gill-rakers, 4 to 7 + 15 to 18; head, 3.1 to 3.3; depth, 2.1 to 2.2.

475. [921] **Tarphops oligolepis** (Bleeker).

Toba (Jordan and Yamamoto); Kobe market (Jordan); Tatoku Island (Mikimoto).

Dorsal, 64; anal, 49; scales in lateral line, 40.

476. [924] **Paralichthys olivaceus** (Temminck and Schlegel).

Hirame = Halibut (Wide-eye); *Magarei* = True Flounder.

Sapporo market (Majima); Takashima market (Takayasu); Tokyo and Kobe markets (Jordan); Toba (Jordan and Yamamoto); Misaki (Aoki); Mikawa Bay (M. Ishikawa); Choshi (C. Ishikawa); Fukui (Nonaka).

Very common southward, the most abundant and valuable of the flat-fishes. In this species the fin-rays are well branched posteriorly. Dorsal rays 70 to 78; anal, 54 to 60.

To the synonymy of this species should apparently be added *Platessa percocephala* Basilewsky, *Pseudorhombus swinhonis* Günther, and *Paralichthys olivaceus* var. *coreanicus* Schmidt. A specimen from Hong Kong has 83 dorsal and 61 anal rays; the type of *P. swinhonis*, from Chifu, has 69 dorsal and 51 anal rays. The range of variation in fin-rays in China and Japan consequently appears to be quite similar. It is quite probable, however, that the fin-rays will be found to show an increase in average number toward the north.

Family PLEURONECTIDÆ.

477. [926] **Verasper variegatus** (Temminck and Schlegel).

Medaka-garei = Minnow Flounder; *Hoshi-garei* = Star-flounder.

Toba (Jordan and Yamamoto).

478. [928] **Xystrias grigorjewi** (Herzenstein). *Mushi-garei* = Caterpillar flounder.

Osaka market (Jordan); Toyama (Yoshizawa); Miyazu.

Dorsal rays, 91; anal, 77. The markings on the body vary from barely evident blotches to strongly ocellated spots.

479. [930 and 932] **Hippoglossoides dubius** (Schmidt). *Abura-garei* = Fat Flounder.

Sapporo market (Majima); Kushiro (Tanaka); Osaka market (Jordan), said to have been shipped to Osaka from near Aomori; Noo.

Dorsal rays, 79 to 86; anal, 61 to 67; gill-rakers, x+11 to 16.

Cynopsetta dubia Schmidt seems identical with *Hippoglossoides katakuræ* Snyder and to be referable to *Hippoglossoides*.

480. [937] **Cleisthenes pinetorum** Jordan and Starks.

Noo; Fukui (Nonaka).

Mr. Hubbs has lately shown that *Protopsetta herzensteini* is congeneric with *Cleisthenes pinetorum* of the east coast of Japan, representing that species in the Sea of Japan, and differing chiefly in the number of gill-rakers. The material at hand confirms these findings, the gill-rakers before the angle of the first arch numbering in seven specimens: 17, 17, 18, 18, 18, 19, 19. *Protopsetta* is apparently a synonym of *Cleisthenes*.

481. [934] **Atheresthes evermanni** Jordan and Starks.

Kushiro (Tanaka).

Dorsal rays, 107; anal, 86 or 87; head, 3.7; depth, 2.8.

482. [938] **Alæops plinthus** Jordan and Starks.

Misaki (Aoki).

483. [939] **Dexistes rikuzenius** Jordan and Starks. *Migi*.

Fukui (Nonaka).

Dorsal rays, 72; anal, 61; no fin-rays branched; pores in lateral line, about 70. *Araias ariommus* Jordan and Starks is the same species as already indicated.

484. [940] **Pleuronichthys cornutus** (Temminck and Schlegel).
Meita-garei = Cloak-flounder.

Tokyo and Kobe markets (Jordan); Toba (Jordan and Yamamoto); Kagoshima (Wakiya); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Fukui (Nonaka); Noo. Everywhere abundant, reaching a small size.

Dorsal rays, 73 to 81; anal rays, 52 to 60; head, 3.8 to 4.2; depth, 1.8 to 2.3; eye, 3.0 to 3.35.

485. [941 and 942] **Lepidopsetta mochigarei** Snyder.
Mochi-garei = Rice-flounder.

Nemuro and Kushiro (Tanaka).

All the records of *Lepidopsetta bilineata* from the Sea of Japan refer apparently to the present species.

Dorsal, 71 to 77; anal, 58 to 61; pores, 100 to 104; gill-rakers, 2+4 to 6; head, 3.3 to 4.0; depth, 2.1.

Genus LIMANDELLA Jordan and Starks.

This group seems fully entitled to generic separation from *Limanda*; jaws very unsymmetrical, as in most pleuronectine flounders.

486. [943] **Limandella angustirostris** (Kitahara). *Kitsunegarei* = Fox-flounder.

Sapporo market (Majima); Takashima (Takayasu); Fukui (Nonaka); Noo.

487. [944 and 945] **Limandella yokohamæ** (Günther).
Kuragoshira; *Makogarei* = True Little Flounder, or Dab.

Takashima (Takayasu); Nemuro (Tanaka); Tokyo and Kobe markets (Jordan); Mikawa (M. Ishikawa); Fukui (Nonaka).

Limanda schrencki seems to be the same species.

Dorsal rays, 61 to 73; anal rays, 48 to 54; pores, 70 to 82; gill-rakers, 3+6 or 7=9 or 10.

The variation in fin-rays in our series covers the supposedly distinctive numbers accredited to the nominal species, *L. schrencki*.

488. [946] **Limanda punctatissima** (Steindachner). *Ran-garei* = War-flounder.

Hippoglossoides (*Hippoglossina*) *punctatissimus* STEINDACHNER, Ichth. Beit., 1879, p. 49 (Situngsb. Akad. Wiss. Wien., LXXX, 1879). (Hakodate).

Limanda iridorum JORDAN and STARKS, Proc. U. S. N. M., XXXI, 1906, p. 206, fig. 14, Mororan.—JORDAN, TANAKA and SNYDER, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 327, fig. 276.—HUBBS, Proc. U. S. N. M., XLVIII, 1915, p. 484.

Takashima (Takayasu); Nemuro (Tanaka).

The description of this species by Steindachner, based on a specimen from Hakodate, has been entirely overlooked.

Body covered with fine beaded lengthwise streaks, and with small dark spots. Head, 3.2 in length; depth, 2.1; dorsal, 61; anal, 48; scales, 73.

489. [954] **Kareius bicoloratus** (Basilewsky). *Ishigarei* = Rock-flounder.

Sapporo market (Majima); Takashima market (Takayasu); Tokyo and Osaka markets (Jordan); Mikawa (M. Ishikawa); Fukui (Nonaka). Common northward.

Young, 24 mm. long to caudal fin, are fully transformed, and show all adult features other than the bony plates. At 39 mm. they show traces of the developing bony plates, but are otherwise naked, while somewhat larger specimens (55 to 150 mm. long) have the body covered with small, thin, imbedded scales, visible to the naked eye. Still larger specimens agree with the current descriptions of the species in lacking evident scales.

490. [955] **Clidoderma asperrimum** (Temminck and Schlegel).
Same-garei = Sturgeon-flounder.

Kushiro and Nemuro (Tanaka).

Dorsal rays, 86 to 91; anal, 66 to 69; head, 3.2 to 3.5; depth, 1.7. Common northward.

491. [956] **Microstomus stelleri** Schmidt. *Baba-garei* = Old-woman-flounder.

Kushiro (Tanaka).

Dorsal rays, 87 to 95; anal, 72 to 79; scales, 120 to 138; head, 5.5; depth, 2.3.

Genus TANAKIUS Hubbs.

Tanakius HUBBS, Annot. Zoöl. Jap., IX, 1918, p. 370 (not *Tanakia* Jordan and Thompson, 1914).

This genus differs from *Dexistes*, with which it seems most closely allied, in the increased number of segments and in the branching of a few of the posterior rays in the dorsal and anal fins. From *Microstomus*, with which it has been confused, it differs in the scaly eyeball, the occurrence of teeth on both sides of the jaws, the well imbricated scales, and the lack of accessory scales along the pores of the lateral line, the straight lateral line, the doubly truncate, instead of rounded, caudal fin, and the thinner and weaker texture of body, skin, and fin-rays.

492. [957] **Tanakius kitaharæ** (Jordan and Starks).
Yanagi-mushi-garei = Willow-caterpillar Flounder.

Microstomus kitaharæ JORDAN and STARKS, Bull. U. S. Fish. Comm., XXII, 1902 (1904), p. 622, with plate; Proc. U. S. N. M., XXXI, 1906 (1907), p. 223.—HUBBS, *ibid.* XLVIII, 1915, p. 490.

Dexistes (*Tanakius*) *kitaharæ* HUBBS, Annot. Zoöl. Jap., IX, 1918, p. 371.

Microstomus hireguro TANAKA, Zoöl. Mag. XXVIII, 1916, p. 67; Fig. Desc. Fishes Japan, XXV, 1917, p. 447, pl. 122, fig. 351.

Toyama (Yoshizawa); Noo, Fukui (Nonaka).

Dorsal rays, 85 to 102; anal, 74 to 76; depth, 2.75 to 3.25.

493. [958] **Glyptocephalus ostroumowi** Pavlenko. *Isami-garei* = Bold Flounder.

Glyptocephalus sasæ SNYDER, Proc. U. S. N. M., XL, 1911, p. 548.

Sapporo market (Majima); Fukui (Nonaka); Miyazu, Noo.

Family SAMARIDÆ.

Genus PLAGIOPSETTA Franz.

Eyes dextral; mouth small, but nearly symmetrical, with narrow bands of teeth on the jaws; scales of moderate size, strongly ctenoid on both sides; lateral line straight, with an irregular backward-directed branch; dorsal fin beginning just before orbit, like the anal extended to, but free from, the caudal; the rays on the head partially free, but scarcely produced; pectoral large, scythe-shaped, with ten rays on the eyed side, wholly wanting on the blind side; both ventrals lateral and nearly symmetrical, each of five rays; caudal fin acutely rounded, with twelve branched rays; none of the other fins with branched rays; both sides pigmented.

494. [922] **Plagiopsetta glossa** Franz.

One specimen of this interesting little samarid flounder is at hand, having been obtained by Aoki at Misaki.

Dorsal rays, 69; anal, 54.

Family ACHIRIDÆ.

495. [959] **Heteromycteris japonica** (Temminck and Schlegel).
Sasa-ushinoshita = Bamboo-sole.

The genus *Amate* Jordan and Starks, to which this species has hitherto been assigned, seems to be inseparable from *Heteromycteris* Kaup (1858), based upon *Heteromycteris capensis* Kaup.

Toba (Jordan and Yamamoto); Misaki (Aoki).

Dorsal, 78; anal, 59; pores, 78.

Family SOLEIDÆ.

496. [960] **Aseraggodes kobensis** (Steindachner).
Tobi-sasa-ushinoshita = Hawk Bamboo-sole.

Misaki (Aoki).

Family SYNAPTURIDÆ.

497. [962] **Zebrias zebrinus** (Temminck and Schlegel).
Shimagarei = Striped Flounder.

Tokyo and Shizuoka (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Misaki (Aoki). Common southward. *Solea fasciata* Basilewsky is probably this species.

498. [963] **Zebrias japonicus** (Bleeker). *Seto-ushinoshita* = Channel-sole.

Toba (Jordan and Yamamoto); Toyama (Yoshizawa); Fukui (Nonaka); Misaki (Aoki).

Family CYNOGLOSSIDÆ.

499. [964] **Rhinoplagusia japonica** (Temminck and Schlegel).
Ushinoshita = Cow-tongue, or Sole.

Tokyo, Yokohama, Osaka, and Kobe markets (Jordan); Toyama (Yoshizawa); Fukui (Nonaka); Miyazu.

A common and valued food-fish, much like the European Sole, commercially much the most important of the group. *Usinosita* Jordan and Snyder, 1900, is a synoym of *Rhinoplagusia*.

500. [966] **Cynoglossus robustus** Günther. *Inunoshita* = Dog-tongue.

?Solea anonyma Basilewsky, Ichth. Chin. Bor., 1855, p. 262 ("Shaudun").

Cynoglossus inusita Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 335 (a substitute name for *Cynoglossus robustus*, thought to be distinct, which it probably is not.

Cynoglossus inusita lacks a definite type-locality; we may supply Kobe. The name *Solea anonyma*, apparently belonging to this fish, is prior to *robustus*.

501. [968] **Areliscus joyneri** (Günther). *Umanoshita* = Horse-tongue.

Shizuoka market (Jordan).

502. [969] **Areliscus interruptus** (Günther).

Toba (Jordan and Yamamoto); Kobe (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki).

Dorsal rays, 100 to 112; anal, 80 to 88; scales in lateral line from opposite gill-opening, about 66 to 70.

503. [970] **Areliscus purpureomaculatus** (Regan).

Murasaki-garei = Purple Flounder.

Osaka market (Jordan).

Dorsal rays, 127; anal rays, 102; scales from opposite gill-opening, 115; eye, 8.7 in head; body without definite purplish spots, other than fine specks.

Family ELEOTRIDÆ.

ENCÆURA Jordan and Hubbs, gen. nov.

Type: *Encœura evides* sp. nov.

Head and body compressed throughout, rather slender, with evenly curved contours. Scales minute (about 125 from gill-opening to caudal base) poorly imbricate, not definitely aligned into rows, each usually with a single very slender spine; body closely scaled as far forward as the isthmus and the occiput, which is located far forward, above the middle of the eye; head wholly scaleless. Dorsal spines six, the last one widely separated from the others, all slender and flexible, but not at all filamentous; dorsal fins barely connected by membrane at extreme base; soft dorsal and anal elongate, each with about twenty-five rays, but free from caudal; caudal fin emarginate, with the lobes rounded; pectorals rounded; ventrals rather short, wholly separated, but with the bases in contact, each with only four soft rays. Mouth rather small, with a straight oblique gape; mandible rather heavy, projecting; lips rather thick; teeth on jaws only, conic, sharp, rather large, well spaced, uniserial. Tongue very narrow, compressed, pointed. No barbels. No spines on head. Branchiostegals 4+1 (as in *Gobiidæ*; usually 4+2 or 4+3 in the *Eleotridæ*). Gill-membranes united to the sides of the narrow isthmus, not conjoined. Inner edge of shoulder-girdle sharply angulated, without processes.

Among Japanese genera *Encœura* agrees best with *Vireosa*, but is not closely related to it. It also differs in many respects from all the East Indian genera of the family.

504. [973A] **Encæura evides** Jordan and Hubbs, sp. nov. (Plate XI, fig. 2.)

The type is 42 mm. in length to caudal. It was taken together with a slightly smaller paratype at Wakanoura by Professor Yamamoto. (C. M. Cat. Fishes, No. 7931.) The paratype is retained at Stanford University.

Dorsal, VI–25 or 26; anal, 25; caudal with 11 or 12 branched rays; pectorals, 23 or 24; ventrals I, 4. Head 4.0; depth 5.1 in standard length. Least depth of caudal peduncle, 2.3 to 2.5 in head; length of orbit, 3.6 to 3.65; snout, 3.7 to 3.8; width of fleshy interorbital, 3.0 to 3.3; upper jaw, 2.65 to 2.75; depth of head, as measured on vertical through end of opercle, 1.5; width of head, 1.8 to 1.9. Head with even contours; eye roundish, rather high, slightly longer than snout, but shorter than the fleshy interorbital width, directed laterally. Maxillary completely ensheathed extending to between verticals from front of orbit and front of pupil. The form and proportions of the fins are well shown in the figure.

Color brown in the type (pale in the paratype), becoming dark only along front of orbit and near tip of jaws; a large, conspicuous, oval, blackish, indefinitely ocellated spot, located half on the body and half on the caudal fin. First dorsal pale dusky (or whitish), becoming blackish only on extreme margin; second dorsal and anal dusky, becoming black distally; upper and lower caudal margins widely blackish; pectoral pale dusky; ventral clear.

Odontobutis Gill.

Odontobutis Gill is apparently distinct from *Mogurnda* Gill.

505. [977] **Odontobutis obscurus** (Temminck and Schlegel).

Isago-haze = Sand-Goby.

Kumamoto, Ozu, Hamada (Wakiya); Himeji (Abe). The University of Michigan has received specimens from Soo-chow, China.

A fresh-water species.

506. [Extraterr.] **Micropercops dabryi** Fowler and Bean.

Specimens in the University of Michigan collected by Mr. Gee at Soo-chow, China.

507. [978] **Eleotris oxycephala** Temminck and Schlegel.

Kumamoto in fresh-water (Wakiya).

Family PERIOPHTHALMIDÆ.

508. [979] **Boleophthalmus pectinirostris** (Gmelin). *Mutsugoro* = Adventurer.

Apocryptes chinensis (Osbeck) (1757, pre-Linnæan).

Brackish water, Bay of Ariaka (Wakiya)

Until the pertinence of *Apocryptes* is finally settled, we retain the familiar name for this agile Goby of the tide-flats.

Family GOBIIDÆ.

Genus Hazeus Jordan and Snyder.

509. [981] **Hazeus otakii** Jordan and Snyder.

The genus *Hazeus* is probably separable from *Gnatholepis* Bleeker, having the dorsal and anal fins much shorter. The genus *Vaimosa* Jordan and Seale (Type: *Vaimosa fontinalis* from Samoa) is apparently distinct from *Mugilogobius* Smitt.

Genus RHINOGOBIUS Gill.

We retain the name *Rhinogobius* instead of the earlier *Ctenogobius*, also of Gill, as the latter is based on a South American species, of which the characters are imperfectly known.

510. [982] **Rhinogobius similis** Gill. *Haze* = Goby; *Yoshinobori* = Reed-fish.

Rhinogobius similis GILL, Proc. Acad. Nat. Sci. Phila., 1859, p. 145 (near Shimoda, Japan).

Ctenogobius similis JORDAN and SNYDER, Proc. U. S. N. M., XXIV, 1901, p. 56.

Gobius yokohamæ GÜNTHER, Ann. Mag. Nat. Hist., (4) XX, 1877, p. 437 (Yokohama).

Rhinogobius nagoyæ JORDAN and SEALE, Proc. U. S. N. M., XXX, 1906, p. 147, fig. 5.

Ctenogobius bedfordi REGAN, Proc. Zoöl. Soc. Lond., 1908, p. 62 (Chong-ju, Korea).

Ctenogobius candidius REGAN, Ann. Mag. Nat. Hist., (8) I, 1908, p. 153 (Lake Candidius, Formosa).

Rhinogobius candidius OSHIMA, Ann. Car. Mus., XII, 1919, p. 295.

Rhinogobius taiwanus OSHIMA, *l. c.*, 1919, p. 298, pl. LIII, fig. 1 (Formosa).

Kumamoto and Ozu (Wakiya); Hiki River and Shirarahama, Kishu (Jordan); Lake Biwa at Otsu (Jordan and Kawamura); Lakes Hakone and Suwa (Jordan); Yamaguchi, Fukui.

The commonest of all the small gobies or "Haze" in brooks and estuaries.

Rhinogobius similis is a very variable species, differing with age, sex, locality, and individuals. The individual variations chiefly involve the squamation: the relatively large scales of the body may impinge directly on the entirely naked nape, or these scales may gradually become reduced in size anteriorly, and extend well toward, in rare cases almost to, the occiput; in correlation with this variation in size, the scales vary in number from about 30 to about 40 between the gill-slit and the caudal base. These variations in squamation cover the characters of several nominal species, *R. nagoyæ* of Japan, *R. bedfordi* of Korea, and *R. candidius* and *R. taiwanus* of Formosa. We have examined large series from Formosa, as well as from Japan, and have examined the type of *Rhinogobius nagoyæ*, which in every way is typical of *R. similis*.

511. [986] **Rhinogobius giurinus** (Rutter). *Gokurake-haze* = Paradise-Goby.

Gobius giurinus RUTTER, Proc. Acad. Nat. Sci. Phila., 1897, p. 86 (Swatow, China).

Rhinogobius giurinus JORDAN and RICHARDSON, Mem. Car. Mus., IV, 1909, p. 200. —OSHIMA, Ann. Car. Mus., XII, 1919, p. 297 (Formosa).

Ctenogobius hadropterus JORDAN and SNYDER, Proc. U. S. N. M., XXIV, 1901, p. 60, fig. 7 (Japan).

Kachi River at Nagoya (Jordan); Lake Togo, Inaba. We also have a specimen from Soo-chow, China, as well as much material already reported on from Japan, Formosa, and China.

In all our material we count about 30 scales between gill-opening and caudal base. We can find no basis for the distinction of a Japanese species, *R. hadropterus*, differing from the Chinese *R. giurinus*.

512. [988 and 989] **Rhinogobius pflaumi** (Bleeker). *Moyo-haze* = Pattern-goby.

Ctenogobius virgatulus JORDAN and SNYDER, Proc. U. S. N. M., XXIV, 1901, p. 63, fig. 9.

Kobe market (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki). Another specimen from Misaki was found in the throat of a Flat-head, *Inegocia japonica*, collected by Jordan in 1911.

In specimens of like size, we have found no difference in the size of the eye between paratypes of *Ctenogobius virgatulus* and specimens of *R. pflaumi*. The former show in part a black blotch in the branchiostegal region, while the latter may show dark rims along the series of scales. These were the only tangible differences by which the nominal species, *C. virgatulus*, was distinguished.

513. [991] **Rhinogobius kurodei** (Tanaka).

Kachi River at Nagoya (Jordan); Noo.

The specimens from the Kachi River, except for a slightly stouter form and smaller eye, agree in detail with the description of the type.[131] They show the following characters: dorsal rays, VI–9; anal, 8 or 9; scales 28–10; head, 3.3 to 3.4; depth, 4.5 to 5.2; eye, 4.0 to 5.0; snout, about 4.0; upper jaw, 2.6 to 2.7, extending to below front of pupil; head a little wider than deep, but not nearly so wide as long; dorsal and anal fins reaching nearly to caudal base, when depressed, in the case of the males, but much shorter in the females; ventrals reaching only half or two-thirds the distance to anus.

Fins all white-edged; the dorsals and caudal spotted in females, blackish in males; paired fins and anal nearly colorless in females, dusky in males.

Three specimens from Noo are referred with more or less doubt to the present species. Dorsal rays, VI–9; anal, 9; head, 3.0 to 3.4; depth, 4.7 to 5.5; eye, 4.3 to 5.0; snout, 3.8 or 3.9 in two specimens, 3.4 in the largest one; scales, 30 to 34 to

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[131] Annot. Zoöl. Jap., VII, 1908, p. 33.

10; head wider than deep, two-thirds as wide as long; upper jaw 2.6 to 3.0, extending a little beyond front of orbit; fins low; ventral reaching half or two-thirds the distance from its base to anus. Body and fins spotted, varying to nearly plain; the fins all dark-edged.

514. [999] **Aboma lactipes** (Hilgendorf). *Ashi-shiro-haze* = Rush-white Goby.

Lake Kitagata near Fukui; Noo; near Morioka (Awaya); Soo-chow, China (Gee). So far as we know, this species has not been previously recorded from China.

515. [1000] **Aboma tsushimæ** Jordan and Snyder.

One specimen was found among several hundred small gobies obtained by Dr. Jordan in the Kachi River at Nagoya. It agrees well with the types of the species. The original figure shows the contour of the head as much too blunt, a condition produced by the partial protraction of the premaxillaries. When normally closed the snout has about the same form as that of *Aboma lactipes*.

516. [1007] **Cryptocentrus filifer** (Cuvier and Valenciennes).
Ito-hiki-haze = Thread Goby.

Misaki (Aoki); Kobe (Jordan).

517. [1010] **Glossogobius brunneus** (Temminck and Schlegel).
Uro-haze = Rain Goby.

Mikawa Bay (M. Ishikawa).

518. [1012] **Chænogobius macrognathos** (Bleeker). *Ukigori* = Wet ditch Fish.

Yodo River at Kyoto (Jordan); brook at Yamawa, Kagoshima Bay, and brook at Kumamoto (Wakiya); Himeji (Abe); Aomori (Beppu); Lake Biwa at Otsu (Jordan and Kawamura); Lake Hakone (Jordan); Lake Kasumigaura (Hattori); near Yamaguchi. Generally very common in ponds and estuaries.

519. [1013 and 1018] **Chloea castanaea** (O'Shaughnessy).

Gobius castaneus O'Shaughnessy, Ann. Mag. Nat. Hist., (V) XV, 1875, p. 145.
Chloea castanea Jordan and Snyder, Proc. U. S. N. M., XXIV, 1901, p. 79.
Chloea nakamuræ Jordan and Richardson, Proc. U. S. N. M., XXXIII, 1907, p. 265, fig. 3.
Chloea senbæ Tanaka, Zoöl. Mag. XXVIII, 1917, p. 228.

Kachi River at Nagoya and in tributary of the Sumida River near Tokyo (Jordan); Aomori (Beppu); Noo; Akita; Fukui; Morioka (Awaya). Generally common.

This species varies considerably with the locality, but a study of an extensive series has not resulted in the defining of any sharply marked races. We are therefore compelled to refer to *C. castanea* two of the local forms, which have been named *nakamuræ* and *senbæ*. The variations seem to involve chiefly the proportions. The head is contained from 2.9 to 3.75 times in the standard length; the upper jaw 2.2 to 3.0 times in the head.

520. [1020] **Chasmichthys gulosus** (Guichenot). *Dorome* = Mud-eye.

Misaki (Aoki).

One male nearly black in color.

521. [1022] **Pterogobius daimio** Jordan and Snyder.
Kishiki-haze = Brocade Goby.

Misaki (Aoki).

We have nothing to add to the discussion regarding the relation of *P. daimio* and *P. elapoides*, and so we follow the last conclusion by Jordan and Thompson[132] that the two are distinct species, or perhaps geographical races.

522. [1027] **Acanthogobius flavimanus** (Temminck and Schlegel).
Ma-haze = True Goby.

Misaki (Aoki); Tokyo market and Kachi River at Nagoya (Jordan); Toba (Jordan and Yamamoto); fresh-water at Kumamoto (Wakiya); Mikawa Bay (M. Ishikawa); Himeji (Abe); Toyama (Yoshizawa); Lake Biwa (Jordan); Fukaoka (Hamada); Fukui (Nonaka); Noo; Lake Kasumigaura (Hattori).

The species attains a considerable size, being in fact the largest, as well as one of the most abundant of the "Haze," coming daily into the markets.

523. [1030] **Parachæturichthys polynema** Bleeker. *Hige-haze* = Bearded Goby.

Kobe (Jordan).

524. [1032] **Chæturichthys hexanema** Bleeker. *Dainan-haze* = Disaster-goby.

Shizuoka and Kobe (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Fukui (Nonaka).

Dorsal rays, VIII–16 or 17; anal, 13 or 14.

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[132] Mem. Car. Mus., VI, 1914, p. 289.

525. [1034] **Ainosus geneionemus** (Hilgendorf).

Toba market (Jordan and Yamamoto).

Two adults, 80 to 82 mm. long to the caudal base, agree well with Jordan and Snyder's description of half-grown specimens, except that the spot on the posterior part of the dorsal is less prominent. In this species the tongue is not strictly truncate, as described, but is slightly emarginate.

526. [1035] **Triænopogon japonicus** Rendahl. *Shoki-haze* = Summer Goby.

According to Rendahl the Japanese species of *Triænopogon* is distinct from the Chinese *Triænopogon barbatus* Günther.

We have but one example of this species, taken by Hamada near Fukuoka.

527. [1036] **Sicyopterus japonicus** (Tanaka).
Bozu-haze = Priest-goby (Shaven Head).

Five specimens from the River Tonda in Kishu, collected by H. Kuroiwa, Sept. 17, 1922. We have other specimens from near Uwajima in Iyo, Shikoku, in which region it is common.

Body above anal fin with horizontal rows of spots.

528. [1037] **Tridentiger obscurus** (Temminck and Schlegel). *Chichibu.*

Ctenogobius atriceps JORDAN and THOMPSON, Ann. Car. Mus., VI, 1914, p. 287 (Nagoya). (Not of Regan.)

Lake Togo, Tottori (Inomata); fresh-water at Kumamoto (Wakiya); Kachi River (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Himeji (Abe); Tonda River, Kishu (Kuroiwa); Aomori (Beppu); Lake Biwa (Jordan); Morioka, Rikuchu (Awaya); Noo, Lake Mikata, Fukui.

We have re-examined the material recorded by Jordan and Thompson from Nagoya as *Ctenogobius atriceps*, and have found their specimens to be referable rather to *Tridentiger obscurus*. This little fish is generally very abundant in estuaries.

529. [1039] **Tridentiger bifasciatus** Steindachner. *Shima-haze* = Striped Goby.

Hachi River at Nagoya (Jordan); Mikawa Bay (M. Ishikawa).

530. [1049] **Luciogobius elongatus** Regan.

Noo.

531. [1051] **Leucopsarion petersi** Hilgendorf.

A series of this diminutive Goby was collected by Y. Tsuchiga at Isobemura, near Yamada in Ise.

Genus TÆNIOIDES Lacépède.

Two species of this genus occur in Japan. On comparison we find that they agree in having the body naked, the dorsal and anal fins united for their full height to the caudal, the soft rays in each fin more than forty in number, a pair of small mental barbels, and the length of the head contained one and one-half times in the distance between the insertion of the ventral fin and the anus. They differ widely however, in other respects, as the following key will indicate:

KEY TO THE JAPANESE SPECIES OF THE GENUS TÆNIOIDES.

a. Dorsal fin beginning scarcely behind the moderate pectoral, which is more than two-thirds length of ventrals, which extend half-way to front of anal; head about six times in length to base of caudal (shown too short in Schlegel's plate), two-thirds length of caudal fin; depth of body 10 in length; dorsal rays VI, 44; anal, 41; mouth very oblique, its angle about forty-five degrees with the vertical. *lacepedei.*

aa. Dorsal fin beginning well behind the very short pectoral fin, which is about two-fifths length of ventral, the latter extending two-thirds distance to origin of anal; head 7.5 in length, longer than the caudal fin; depth seventeen times in length; dorsal rays VI, 46; anal, 44; cleft of mouth almost vertical; cheeks not tumid .... *snyderi*

532. [1054A] **Tænioides lacepedei** (Temminck and Schlegel).

We have a specimen of a *Tænioides,* which is obviously the species described by Temminck and Schlegel, but certainly not the one called *T. lacepedei* by Jordan and Snyder. This was collected by Hamada near Fukaoka. Dorsal rays VI, 44; anal, 41 (counting the last ray as a double one).

533. [1054] **Tænioides snyderi** Jordan and Hubbs, sp. nov. *Warazube* = Straw-Goby

Tænioides lacepedei JORDAN and SNYDER, Proc. U. S. N. M., XXIV, 1901, p. 128, fig. 33 (not *Amblyopus lacepedei* Temminck and Schlegel, which is the species listed above).

We are unable to identify this species with any which have been described from East Indian waters. Its characters are intimated in the key inserted above and in Jordan and Snyder's description. *Tænioides abbotti,* described by Jordan and Starks (Proc. U. S. N. M., XXXI, 1907) from Port Arthur, is plainly different, having a much longer pectoral, reaching much beyond the ventrals, a longer head.

Family PARAPERCIDÆ.

534. [1055] **Parapercis pulchella** (Temminck and Schlegel).

Tora-gisu = Tiger-gisu.

Misaki (Aoki).

535. [1056] **Parapercis ommatura** Jordan and Snyder.

Toba (Jordan and Yamamoto); Kobe (Jordan).

536. [1058] **Neopercis sexfasciata** (Temminck and Schlegel).

Yokohama, Tokyo, and Kobe markets (Jordan); Misaki (Aoki); Toyama (Yoshizawa); Fukui; Shizuoka, where it is used for making fish-curd.

Color in formalin: general tone pink on dorsal half of body, yellow on lower sides, grading to whitish below; the colors due to the spots on the center of the scales, the margins of the scales being broadly gray, darker above, pale below. Head with narrow lines of brilliant yellow, breaking up into spots on cheeks and opercles, the most prominent line running from the suborbital edge backward and upward to eye, then backward along the lower orbital margin. Upper lip yellowish posteriorly, becoming dusky toward symphysis. Soft dorsal with three longitudinal streaks, the proximal and marginal ones yellow, the lower median orange and the upper median red; the dorsals blackish near base, where the branches of the body-bars extend a short distance upon the fin. Caudal barred upon upper edge with black and white, mottled reddish and dusky medially, becoming blackish toward the extreme white margin ventrally. Anal with the front of each interradial membrane yellow. Pectoral mostly pale pinkish, but yellowish toward the broad black mark at base of fin and along the lower edge; ventral pale dusky.

537. [1059] **Neopercis multifasciata** (Döderlein).

Oki-tora-gisu = Off-shore Tiger-gisu.

Kagoshima Bay (Wakiya); Misaki (Aoki).

Family TRICHODONTIDÆ.

538. [1066] **Arctoscopus japonicus** (Steindachner). *Hata-hata* = Grasshopper.

Kushiro (Tanaka); Toyama (Yoshikawa); Noo.

The number of dorsal spines, which has been used as one of the chief generic characters of *Arctoscopus*, varies from nine to fourteen, and hence may be as numerous as in *Trichodon*. The spines, however, are much more flexible and weaker than in that genus, and the two dorsal fins are much more widely separated. The pectoral rays are also much less thickened, and the dermal folds on the lips much smaller.

Family URANOSCOPIDÆ.

ZALESCOPUS Jordan and Hubbs, gen. nov.

Type: *Zalescopus tosæ* Jordan and Hubbs.

This genus is closely related to *Uranoscopus*, with which it agrees in nearly all characters, but from which it differs in having the nuchal region densely covered with small imbedded scales, and the suborbitals wider. In *Uranoscopus* the nape is naked. The known species are uniform in coloration, or nearly so, whereas those of *Uranoscopus* mostly show a highly variegated color-pattern.

KEY TO THE SPECIES OF ZALESCOPUS.

a. Respiratory valve prolonged into a very slender non-fimbriate, black filament, nearly two-fifths length of head; top of head slightly concave; scapular spines stronger and longer, less tuberculate; preopercular spines four, stronger; dorsal rays, IV–14; scale-rows all directed downward and backward .... *tosæ*.

aa. Respiratory valve merely pointed, not prolonged into a retractile filament; top of head (excluding minor concavities) about flat; spines of scapular plate shorter and more strongly tuberculate; preopercular spines five or six; dorsal rays, IV–13; several scale-rows below interval between the dorsal fins usually directed downward and forward .... *satsumæ*.

539. [1066B] **Zalescopus tosæ** Jordan and Hubbs, sp. nov.

(Plate XI; fig. 3.)

The type alone is known; it is 138 mm. long to the caudal base, and was collected at Kochi in Tosa on the island of Shikoku by Yōjirō Wakiya. C. M. Cat. Fishes, No. 7945.

This species is very distinct from the other Japanese species, with which it is compared in the foregoing key. It corresponds in most respects with descriptions of *Uranoscopus crassiceps* (Alcock), a species inhabiting considerable depths in the Indian Ocean. It appears, however, to have a smaller head and a shorter retractile filament, and perhaps further differs in the scaly nape (a character not described by Alcock).

Dorsal rays, IV–14; anal, 13; caudal, 12 (10 branched); pectorals, 18; ventrals, I, 5. Head from middle of margin of upper lip to tip of opercular fringe 2.8 in total length to caudal base; greatest depth of body, 4.15; least depth, 3.45 in head; width of head, 1.15; depth below occiput, 1.45; length of orbit, 5.4; of snout, 6.3; least interorbital width, 5.65; length of interorbital fossa, from front of lip, 3.85; extreme width of gape, 2.35; length of upper jaw, 2.45. Form of head and body and course of contours as in the next species, except that the top of the head is slightly concave. Armature of the head and the surface sculpturing are as described for *Z. satsumæ*, except that the tubercles are somewhat coarser, the preorbital definitely ridged, the preopercular spines only four in number, spines of scapular plate freer of tubercles and longer, the largest about as long as orbit, and directed almost straight backward, the humeral spine less deeply grooved, and directed almost as much backward. Upper lip obscurely, lower lip strongly but simply, fimbriate; respiratory valve smooth-edged, produced into a very slender, flat, unfringed retractile filament of blackish color, nearly two-fifths as long as head. Teeth, opercular, branchial, and gular membranes as described for *Z. satsumæ*; the process on the inner edge of the shoulder-girdle much more obtuse. Squamation as in *Z. satsumæ*, except that none of the scale-rows are reversed in direction. Fins as described for *Z. satsumæ*, except that the fourth dorsal ray is half as long as head, the pectoral and ventral rays less thickened.

Color uniformly purplish brown over entire body, even on belly behind ventral fins, but much darker above than below; first dorsal jet-black, except for a narrow white base; second dorsal dusky, with a darker streak on each membrane, and traces of spots along the sides of the rays; caudal light dusky with narrow borders, blackish above, and whitish behind and below; pectoral darkish on both sides, except along the exserted tips of the lower rays; anal and ventral each with considerable dark pigment, that on the ventral located in a long indefinite blotch near the inner margin of the fin.

540. [1067] **Zalescopus satsumæ** Jordan and Hubbs, sp. nov.

Nirame-okose = Star-Okose. (*Okose* = Poison-fish).

Uranoscopus oligolepis Tanaka, Fig. Desc. Fishes Jap., XVIII, 1914, pl. 88, fig. 286; XIX, 1915, p. 327 (description and figure, but not name, nor synonymy).

Type 166 mm. long to caudal fin, collected by Wakiya in Kagoshima Bay, Province of Satsuma, C. M. Cat. Fishes, No. 7949. A paratype, 182 mm. long, with the same data, is preserved in the Stanford Collection. A specimen 120 mm. long, taken by Aoki at Misaki, probably belongs to the same species. It agrees with the specimen from Kagoshima in all important respects, except that the color is darker and more variegated dorsally, especially toward the nape, where distinct blackish reticulations on a light ground-color may be seen.

Zalescopus satsumæ seemingly is closely related only to *Z. tosæ*, to which it bears a striking similarity. The two species, however, apparently differ widely in structural features, as indicated in the foregoing key.

Dorsal rays, IV–13; anal, 13; caudal 12 (10 branched); pectorals, 18; ventrals, I, 5. Head from middle of margin of upper lip to tip of opercular fringe, 2.65 (2.6) in total length to caudal base; greatest depth of body, 4.1 (3.75); least depth of caudal peduncle, 3.9 (3.5) in head; width of head, 1.12 (1.15); depth below occiput, 1.6 (1.5); length of orbit, 5.5 (5.6); length of snout, 5.5 (5.6); least interorbital width, 5.3 (5.55); length of interorbital fossa from front of premaxillaries, 3.65 (3.8); extreme width of gape, 2.15 (2.2); length of upper jaw, 2.45. Ventral contour nearly straight, rising from pubic spines to chin at an angle of about 120°; dorsal contour very slightly curved from tip of snout to dorsal fin, and along base of second dorsal; head and trunk depressed; tail compressed, becoming thinner toward caudal. Head angulated ventrolaterally, rounded dorsolaterally, flat on top. Bones of head widely exposed, covered with moderately coarse sculpturing, composed of tubercles, which are at once united to form a reticulation, and aligned to form radial ridges; the sutures marked by rather sharp channels; no definite occipital lobes developed; preopercular limb joined with opercle by broad bony ridges; preopercle with five or six spines, and subopercle with one spine at lower margin; preorbital projecting sharply over upper jaw, with coarsely emarginate borders, but without definite ridges (except in smaller specimen from Misaki); suborbitals widely expanded, almost covering upper part of cheeks, separated from preopercle by a naked strip, only one-fifth to one-sixth as wide as the orbit; interorbital fossa widely dilated, rather than constricted anteriorly, not extended backward to line joining posterior margins of orbits; scapular plate covered with tubercles to, or almost to, extreme tips of spines, of which one to three of small size point inward and backward, the largest one (shorter than orbit) outward and backward; humeral spine long and sharp, smooth, except for longitudinal ridges and grooves, directed backward and a little upward, its length one-half greater than that of orbit. Upper lip obscurely, lower lip rather strongly, but simply, fimbriate; lower (main) respiratory valve smooth-edged, obtusely pointed, not prolonged into a retractile filament. Teeth in jaws pointed, larger in the lower than in the upper jaw, in two series on front of mandible, in one series laterally (where they are few in number) very large, spaced, sharp, triangular, with compressed bases; premaxillary teeth in two series widely separated by a band near symphysis and more narrowly by one series on median (anterior) half of sides, converging to meet at end of band; teeth in a patch on each side of vomer and on each side of palatine. Opercular membrane finely fringed; gill-membranes largely free from isthmus, forming a fold in front of the three pubic spines, and covered by a fold of the gular membrane; inner edge of shoulder-girdle with a rounded fleshy lobe. Scales arranged on oblique ridges (about fifty to fifty-six to caudal base) much as in *Uranoscopus*, but several rows below interval between dorsal bases directed reversely, that is, downward and forward; ridges continuous and strong on caudal peduncle; entire area between lateral lines dorsally covered by small imbedded scales. Body naked on belly and backward to a line running from base of humeral spine toward the anal origin, and in a strip, narrowing posteriorly, along anal base. First dorsal small, extremely flexible, a rounded triangle in outline, narrowly separated from the second or main dorsal, in which the rays are abruptly lengthened to the fourth (or third), which is about two-fifths as long as the head, and about twice as high as the anal; caudal sharply truncate, when half expanded; posterior margin of pectoral truncate above, rounding off gradually below into the lower margin, the fin-margin moderately incised between the thickened tips of the lower rays; first three ventral rays much thickened.

Color purplish brown, somewhat puncticulate, but practically uniform in effect dorsally, becoming whitish below (the specimen from Misaki shows dark reticulations above); first dorsal jet-black, except for a clear base, which is very narrow medially; second dorsal light dusky, with olive spots along the edges of the rays; caudal similarly, but less distinctly, marked; pectoral on both faces dusky, with the free tips of the thickened rays whitish, and with traces of dark reticulations just inside this light border; anal and ventrals whitish.

Genus URANOSCOPUS Linnæus.

KEY TO THE JAPANESE SPECIES OF URANOSCOPUS.

a. Respiratory valve smooth, merely pointed, not prolonged into a retractile filament in the adult[133]; interorbital fossa smaller, not extended backward to line joining posterior rims of orbits, and normally more or less constricted anteriorly; suborbitals smaller, the largest little or no longer than orbit; preopercular spines three (a fourth rarely interpolated); head less than one-third the standard length. Occipital lobes well developed; sculpturing of exposed bones of head so fine as to feel velvety to the touch; dorsal rays, IV or V–13 or 14 (usually 14)[134]; scale-rows 40 to 64, (usually more than 50) everywhere aligned along definite folds; upper half of body abruptly darker than lower parts, and marked with more or less rosette-like spots "of rosy or yellowish;" the pattern similar, but finer, on top of head . . . . *japonicus.*

aa. Respiratory valve prolonged into a slightly fimbriate retractile filament at all ages; interorbital fossa larger, extending backward to a line joining the posterior orbital margins, and widely dilated anteriorly; suborbitals wider, the largest nearly twice as long as orbit; preopercular spines four (rarely six, in *U. bicinctus*); sculpturing of head coarser, feeling granular to the touch; head more than one-third the standard length.

  b. Retractile filament broad and flat, shorter than orbit, rarely reduced in adult to a sharp angle; occipital lobes well developed; head only moderately rough; dorsal rays, IV or V–12 or 13; anal, 13; scales larger, the rows 36 to 47, everywhere aligned along definite folds; upper half of sides darker, marked with irregular, but entire (*i. e.*, not rosette-like), "rosy" spots, the pattern obsolescent on head . . . . *oligolepis.*

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[133] The young, 7 to 8 cm. long to caudal fin, have a retractile filament of moderate length, pale in color, membranous and foliaceous, which becomes reduced to an angle of the valve at a length of about 9 cm.

[134] The last soft ray is divided to base in both dorsal and anal fins, as in fishes generally. Throughout this paper this double ray, having but one interneural, is counted as one.

bb. Retractile filament thick, about twice as long as orbit; occipital lobes obsolescent; head extremely rough; traces of light spots on young only; the body crossed by two blackish bars, dorsally more or less disrupted into streaks; top of head transversely streaked; a large blotch on cheeks. *bicinctus.*

541. [1068] **Uranoscopus japonicus** Houttuyn.
Teminondae-okose = Observatory-Sculpin.

Tokyo and Osaka markets (Jordan); Wakanoura (Yamamoto); Kochi; Kagoshima Bay (Wakiya); Toyama (Yoshizawa); Misaki (Aoki); Miyazu; Noo. Generally common in the markets.

The scale-rows are highly irregular, being often fused or divided, varying from 40 to 64. None of the rows, however, show any tendency to be reversed in direction, as they are in *Zalescopus satsumæ.*

542. [1067] **Uranoscopus oligolepis** Bleeker.

Mikawa Bay (M. Ishikawa); Fukui (Nonaka); Tokyo market (Jordan and Snyder, 1900, not previously recorded).

Tanaka has confused this species with *Zalescopus satsumæ.*

543. [1069] **Uranoscopus bicinctus** Temminck and Schlegel.
Megane-uwo = Spectacle-fish.

This species was not obtained in our collection made in 1922, but we have examined specimens taken by Jordan and Snyder in 1900 at Tokyo, Misaki, and Wakanoura.

544. [1071] **Gnathagnus elongatus** (Temminck and Schlegel).
Ao-mishima = Blue Lookout-fish.

Miyazu, Noo.

Family CALLIONYMIDÆ.

545. [1077] **Calliurichthys doryssus** Jordan and Fowler. *Numeri* = Dragonet.

Toba market (Jordan and Yamamoto).

546. [1078] **Calliurichthys japonicus** (Houttuyn). *Yome-gochi* = Bride-kochi.

Tokyo market (Jordan); Wakanoura (Yamamoto); Kagoshima Bay (Wakiya); Misaki (Aoki).

547. [1081] **Callionymus lunatus** Temminck and Schlegel. *Numeri-kochi.*

Tokyo market (Jordan); Mikawa Bay (M. Ishikawa); Misaki (Aoki); Noo; Obama.

In females the spinous dorsal may be entirely black; in males the first dorsal spine may be long enough to reach, when depressed, beyond the end of the second dorsal base; the other spines, of which the fourth is longest, are never produced.

These small fishes, like the species of *Platycephalidæ*, go in the markets under the general name of *Kochi* (*gochi* in composition).

548. [1082] **Callionymus richardsoni** Bleeker. *Nezumi-gochi* = Rat-kochi.

Tokyo, Yokohama, and Kobe markets (Jordan); Toba (Jordan and Yamamoto); Mikawa Bay (M. Ishikawa); Fukui (Nonaka).

Jordan and Fowler[135] have transferred the name *Callionymus valenciennie* Temminck and Schlegel (altering the spelling to *valenciennesi*) to the present species, and renamed the true *valenciennei* as a new species, *Callionymus flagris*. The chief distinctive feature of "*C. flagris*," namely the produced dorsal spines, is specifically mentioned and figured for *valenciennei* by Schlegel. The valid name for the present species appears to be *C. richardsoni*. The name *Callionymus punctatus* Langsdorff, applied to the species by Richardson, has no standing, having been based upon the following remark by Valenciennes:

"Dans son état de dessication il parait uniformément brun, avec du noir à la dorsale; mais il y a lieu de croire que ce poisson, frais, avait quelques taches ou points, car M. Langsdorff, qui le rapportait au genre des platycéphales, lui avait donné l'epithète de *punctatus*."

In other words, Langsdorff had merely misidentified the fish as *Platycephalus punctatus* = *Cocius crocodilus*.

In the young of both sexes the spinous dorsal is marked with an ocellus. In the females the ocellus persists throughout life, while in the male it usually disappears, being gradually replaced by a black border on the fin. Both ocellus and border exist together in half-grown, and even occasionally in large adult, males.

549. [1083] **Callionymus beniteguri** Jordan and Snyder.
Tobi-numeri = Hawk-Dragonet; *Beni-tiguri* = Red Dragonet.

Toba (Jordan and Yamamoto); Kobe (Jordan); Tatoku Island (Mikimoto); Mikawa Bay (M. Ishikawa).

550. [1086] **Callionymus valenciennei** Temminck and Schlegel.

Callionymus valenciennei TEMMINCK and SCHLEGEL, Fauna Japonica, Pisces, 1845, p. 153, pl. 78, fig. 3.

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[135] Proc. U. S. N. M., XXV, 1903, p. 950, fig. 6.

Callionymus flagris Jordan and Fowler, Proc. U.S.N.M., XXV, 1903, p. 952, fig. 7.

Kobe market (Jordan); Toba market (Jordan and Yamamoto).

Jordan and Fowler adopted the name "*valenciennesi*" for *Callionymus richardsoni* Bleeker. Temminck and Schlegel's figure certainly does not represent that species, but it is a fair, though not perfect, representation of the form named "*flagris*" by Jordan and Fowler. The produced dorsal spines and caudal rays, the form of the preopercular spine, and the coloration, all agree much better with *C. flagris* than with *C. richardsoni*. As in *C. richardsoni*, the dorsal ocellus is present in the young of both sexes, but becomes lost with maturity in the males. The fin-rays also are but little produced in the young males.

Family BLENNIIDÆ.

551. [1099] **Blennius yatabei** Jordan and Snyder. *Iso-ginpo* = Surf Silver-fish.

Tatoku Island (Mikimoto).

Dasson Jordan and Hubbs, gen. nov.

Type: *Aspidontus trossulus* Jordan and Snyder.

A genus of *Blenniidæ* characterized by having the jaws with fixed comb-like teeth, a huge, slightly curved canine in the lower jaw, and a small posterior canine in the upper jaw; gill-opening reduced to a small pore above the pectoral fin; dorsal fin nowhere elevated. It differs from *Petroscirtes* in having the dorsal rays all low, and from *Aspidontus* in the greatly restricted gill-opening.

This genus will include all of the Japanese species heretofore placed in *Aspidontus*. These are: [1102] *Dasson loxozonus* (Jordan and Starks); [1103] *Dasson elegans* (Steindachner); [1104] *Dasson trossulus* (Jordan and Snyder); and [1105] *Dasson japonicus* (Bleeker).

552. [1105] **Dasson japonicus** (Bleeker).

Wakanoura (Yamamoto); Misaki (Aoki).

The lower band may be indistinct on the body, but is always represented on the head by a dark shade, along which a few dark spots are placed; a similar spot is located on the base of the pectoral, and several more on the stripe behind the eye. There are 29 to 32 teeth in the upper jaw, 29 to 30 in the lower jaw, not counting the pair of small canines of the upper jaw, or the pair of strong, but only gently curved, mandibular canines. The lower angle of the caudal fin is scarcely produced in specimens smaller than the type; the type has only the lower lobe produced, while larger ones have both lobes produced. The species attains a length of 90 mm. to caudal.

ONCESTHES Jordan and Hubbs, gen. nov.

Type: *Petroscirtes fluctuans* Weber.

Jaws with comb-like teeth fixed in the bone, with one or two small posterior canines in the upper jaw and a very large canine abruptly bent backward in the lower jaw; gill-opening small, shorter than in *Aspidontus*, but much wider than in *Dasson* and *Petroscirtes*; dorsal fin even, not emarginate, nowhere elevated; form elongate, not strongly compressed.

The only species known is a little fish living in floating sea-weed in the East Indies, ranging northward to Japan.

553. [1105A] **Oncesthes fluctuans** (Weber).

Petroscirtes fluctuans WEBER, Notes Leyden Mus., XXXI, 1888, p. 146; Fische d. Siboga-Expedition, 1913, p. 541, fig. 113.

One specimen, 42 mm. long to caudal, was taken, Nov. 15, at Wakanoura. It agrees fairly well with Weber's description of the species, based upon specimens taken in the East Indies. The wide range of the species may be attributed to its habit of accompanying floating sea-weed.

Body moderately compressed, slender, the greatest depth through the pectoral region being contained 6.4 times in the length to caudal fin; length of head, including opercular membrane, 4.0 times, excluding the membrane 4.35 times in body. Head conical in outline, the snout slightly attenuated, narrowly rounded at tip, and very slightly overhanging the mouth, its length equal to orbit, contained 3.6 times in length of head (with membrane), a little greater than interorbital width. Mandibular canines long and fang-like, bent abruptly backward nearly at a right angle; premaxillary canines two in number on each side, either the anterior or the posterior one the larger; eighteen smaller teeth across the front of each jaw, of which the outermost two of each side are reduced in size. No barbels. Gill-opening about as wide as the base of pectoral, about two-thirds of its length opposite that fin. Dorsal extending from the occiput to, but not beyond, the extreme anterior end of the procurrent caudal rays. Dorsal rays, 36; anal rays, 27. Height of the dorsal, when expanded, less than half depth of body, but the longest ray is two-thirds depth. Length of the truncate caudal a little greater than half of head. None of the fin-rays produced.

A wide dark brown band extends from the eye to the caudal base, sharply separating the body into an upper dark and a lower lighter half; the lower edge of the band runs along the mid-line of the sides, extending to near the caudal base, where the band dips downward to join the black spot on the base of the caudal fin. The body is crossed by eight narrow light wedges, widest and most distinct dorsally, where their centers are darkened. The dark cross-bars between the light ridges are extended into the dorsal and anal fins, which also less definitely show a submedian dark longitudinal streak, which runs just within a pale streak.

Family PHOLIDÆ.

554. [1114] **Enedrias nebulosus** (Temminck and Schlegel). *Ginpo* = Silver-fish.

Tokyo market (Jordan); Toba (Jordan and Yamamoto); Mikawa (M. Ishikawa); Misaki (Aoki). Generally common in the markets.

Family STICHÆIDÆ.

555. [1141] **Dinogunellus grigorjewi** (Herzenstein). *Nagazuku* = Long-straight.

Noo.

556. [1144] **Lumpenus fowleri** Jordan and Snyder.
Nuime-gazi = Stitch-eye Blenny.

Kushiro (Tanaka).

Dorsal spines, 75 to 77. Abundant northward, used in making *Kamoboku*, or fish-curd.

Family ZOARCIDÆ.

557. [1151B] **Furcimanus nakamuræ** Tanaka.

Furcimanus nakamuræ Tanaka, Fig. Desc. Fishes Japan, XVIII, 1914, p. 303, pl. 82, fig. 276.

One specimen of this recently named species is in the collection from Hachi, collected by Nonaka, and one from Noo. These confirm the distinctive features of the species, as outlined by the describer.

Genus Lycogramma Gilbert.

Lycogramma Gilbert, Proc. U. S. N. M., XLVIII, 1915, p. 364.

This genus, based on *Maynea brunnea* Bean, was defined by Gilbert as follows:

"A deep-sea Lycodid, without ventral fins, with wide gill-slits continued well forward under the throat, the two narrowly separated anteriorly; the bones of the head deeply channeled for sensory canals; the body scaled; the lateral lines distinct, two in number, the anterior running high on sides, parallel with the back, discontinued at a point about one orbital diameter behind the vent; the posterior line beginning below and slightly in advance of this point and running along middle of sides of the tail."

To this we may add that the scales completely cover the body to the occiput and to the isthmus, with the exception of an area about the upper end of the gill-opening. The vomerine and palatine teeth are of moderate size, and arranged in from one regular to two irregular rows. The head is broad; the sensory cavities are about as broad as long.

The type-species ranges in deep water from Southern California to Alaska.

558. [1157] **Lycogramma zesta** (Jordan and Fowler). *Shiro-genge* = White Bean.

Bothrocara zesta Jordan and Fowler, Proc. U. S. N. M., XXV, 1902, p. 749, fig. 3.—Jordan and Starks, Bull. U. S. Fish Comm., XXII, 1902 (1904) p. 601, fig.—Jordan, Tanaka, and Snyder, Jour. Coll. Sci., Tokyo, XXXIII, 1913, p. 400.

This species corresponds fully with the diagnosis of *Lycogramma* given above. The obscure lateral lines, although described as absent, appear to follow the courses as described for *Lycogramma*, and they are so indicated in the type-figure. The premaxillary teeth comprise a narrow band toward the symphysis; the palatine teeth form two rows; while the vomerine teeth are strictly uniserial, considerably enlarged, and only five in number, thus fewer than in *L. brunnea*.

Zestichthys Jordan and Hubbs, gen. nov.

This genus agrees fully with *Lycogramma*, as described above, with the following exceptions: the body is scaleless toward the head, on the nape, in a strip behind the pectoral fins, and on the anterior half of the abdomen; the lateral lines are very faint, the upper one short, apparently without pores; the teeth of the jaws, vomer, and palatines form villiform bands; the head is narrow, the sensory cavities much longer than broad. Type-species, *Zestichthys tanakæ*.

559. [1157A] **Zestichthys tanakæ** Jordan and Hubbs, sp. nov.
(Plate XII, fig. 1.)

Type, a specimen 49 cm. long to caudal fin, collected by Shigeho Tanaka at Kushiro; C. M. Cat. Fishes, No. 7951.

Dorsal rays approximately 112; anal not accurately countable; pectoral, 14. Head and trunk together contained 1.7 times in length to caudal; head, 5.85; depth of body, 10.8. Depth vertically below tip of occipital crest, 1.9 in head; width of head, 2.5; width of mouth, 4.4; length of orbit, 2.5; length of eye, 5.65; least interorbital width, 9.6; preorbital length of snout, 5.2; preocular length of snout, 2.8; length of upper jaw, 2.5; mandible, 2.2; distance from lower end of gill-opening to lower edge of pectoral base, 2.8, and to tip of mandible, 1.65; length of gill-slit, 1.9. Head and body compressed, becoming thin posteriorly, the thinness accentuated by the height of the dorsal; dorsal and ventral contours of head similar. Head very soft and cavernous; the cavities elongate, irregular in form; maxillary reaching front of eye, when the mouth is shut; teeth in a narrow band, those of outer row enlarged and well spaced; mandibular teeth in a rather wide band on front of jaw, in three rather even rows laterally, those of outer row less enlarged than in upper jaw. Vomerine and palatine teeth rather small, villiform, in a small vomerine patch and long palatine rows. Gill-rakers $3+13=16$; short, clavate, spiny at tip, soft and translucent. Pseudobranchiæ present at edge of a pit. Body scaleless on the nape, the anterior half of the abdomen, and a connecting strip behind the pectoral base; the head wholly naked; body elsewhere covered with very small moderately imbricated scales; the fins partly scaled, the scales becoming reduced in size and isolated toward the margins of the fins. Individual scales vertically oval in shape, with the focus a little basad of center; the circuli concentric with the margin; the radii numerous, strong, symmetrically radiating in all directions from the focus. Principal lateral line median, beginning over the vent, preceded by a crease without pores; upper lateral line a series of pale spots extending a short distance backward from the upper angle of the gill-opening, apparently without pores. Vertical fins completely confluent; dorsal beginning behind head a distance equal to length of eye, very high, rising to two-thirds depth of body over the anus, and exceeding the height of tail posteriorly, its greatest height 2.8 in head; anal much lower; pectoral somewhat pointed, 1.55 in head; ventrals absent.

Color a light brown, becoming darker on the belly; fins dusky, darkening toward margins, and becoming blackish toward caudal. Named for Dr. Shigeho Tanaka, who collected the type.

Allolepis Jordan and Hubbs, gen. nov.

Type: *Allolepis hollandi* Jordan and Hubbs.

Dorsal fin composed of soft rays only, nowhere especially modified; ventral fins absent; pectoral fins normal; gill-openings wide, but not extended far forward below; the gill-membranes attached to sides of isthmus; premaxillary teeth in an even outer row, considerably enlarged anteriorly, and in a very narrow band, narrowing to a single inner series laterally; mandibular teeth in a rather wide band, with the outer series not much enlarged; vomerine teeth forming a small patch; palatine teeth in a band, with the inner row somewhat enlarged; pseudobranchiæ present; gill-rakers reduced to stubs; head covered with rounded scales behind eyes; body covered with elongate non-imbricate scales arranged at right angles as in *Anguilla, Synaphobranchus,* and other eels, as well as in *Otophidium* and *Murænolepis* (all these unrelated forms); no distinct lateral line.

560. **Allolepis hollandi** Jordan and Hubbs, sp. nov.

(Plate XII; fig. 2.)

Type, 322 mm. long to caudal, collected near Fukui on the Sea of Japan, by Nonaka; C. M. Cat. Fishes, No. 7952. A somewhat smaller paratype, also from Fukui, is retained at Stanford University.

Dorsal rays, about 115; pectoral, 17. Head and trunk, 1.95 in length to caudal; head 6.15; depth, 9.0; depth vertically below tip of occipital crest, 1.8 in head; width of head, 2.6; width of mouth, 4.0; length of orbit, 3.0; length of eye, 3.8; least interorbital width, 6.8; preorbital length of snout, 4.9; preocular length, 3.5; length of upper jaw, 3.0; mandible, 2.6; distance from lower end of gill-opening to lower edge of pectoral base, 3.2, and to tip of mandible, 1.6; length of gill-slit, 2.2. Head and body rather evenly compressed throughout; orbit entering dorsal profile; snout obtusely pointed and projecting a little beyond mouth; maxillary reaching below front of pupil. General texture rather soft; head with large sensory cavities and pores. Dentition and squamation as described under the generic heading. Skin lax.

Individual scales, very small, unequal, always elongate, with various outlines and set at different angles; the focus submedian; the circuli parallel with margin of scales; radii of each scale numerous, strong, radiating in all directions from the focus. Lateral line not evident, reduced to faint creases. Vertical fins completely confluent; dorsal beginning behind head a distance equal to length of pupil; the fin of moderate height, nowhere as deep as body at same point, the longest rays 2.3 in head; anal much lower, but symmetrical with dorsal near caudal; pectoral somewhat pointed, 1.65 in head; no trace of ventrals.

Color pale pinkish brown, darker along dorsal base and top of head, and on opercle. Vertical fins indistinctly margined with blackish.

Family CARAPIDÆ (*Fierasferidæ*).

561. [1159] **Jordanicus sagamianus** (Tanaka). *Kakure-uwo* = Hiding Fish.

Carapus sagamianus Tanaka, Annot. Zoöl. Jap., VII, 1908, p. 40; Fig. Desc. Fishes Jap., 2, 1911, p. 26, pl. 27, fig. 2 (Misaki).

(?) *Carapus sagamius* Franz, Abh. Bayer. Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 31, pl. 5, fig. 25 (Misaki).

Eight topotypes, like the types, taken by Aoki at Misaki. If Franz's statement as to his specimen from Kagoshima, that the gill-membranes are broadly joined to the isthmus is correct, his fish must belong to another genus. His figure, however, closely resembles *Jordanicus sagamianus.*

Family AMMODYTIDÆ.

562. [1163] **Hypoptychus dybowskii** Steindachner.

A number of postlarval, but very young, specimens, apparently belonging to this species, were found in the stomach of a small *Oncorhynchus* from Miyazu.

Hypoptychus steindachneri Franz[136] does not appear to be sufficiently characterized, and is probably the same as *H. dybowskii.*

Family BROTULIDÆ.

563. [1165] **Brotula multibarbata** Temminck and Schlegel.

Itachi-uwo = Weasel-fish.

Misaki (Aoki).

564. [1166A] **Monomitopus kumæ** Jordan and Hubbs, sp. nov.

(Plate XII; fig. 3.)

Type a specimen 363 mm. long to caudal fin, collected at Misaki, Japan, by Kumakichi Aoki (usually affectionately known as "Kuma"), for whom we name the species. The specimen is in the Carnegie Museum, C. M. Cat. Fishes, No. 7954. No other specimens were secured.

This species is similar in many ways to *Monomitopus longiceps* Smith and Radcliffe,[137] but differs more or less in nearly all the counts and measurements. It is perhaps even closer to *Monomitopus microlepis,* described by the same authors.

Dorsal rays, 100; caudal, 9; anal, 86; pectorals, 28. Head, 4.7 in standard length, gibbous and cavernous, rather broadly truncated anteriorly; depth of body, 5.6; eye, 6.8 in head, elliptical in outline; snout, 3.75; very broadly rounded when viewed from above; interior face of rostral fold with a membranous projection on each side; a deep recess on each side of premaxillary processes; maxillary broad and emarginate posteriorly, extending the length of the eye behind eye; length of upper jaw, 1.9; interorbital rounded, its least width 3.5 in head; least suborbital width, 8.5; nostrils without definite tubes, but the posterior margin of each a little elevated, the second separated from the eye by two-fifths the ocular diameter, and from the first by half the length of the eye. Teeth all subgranular, in moderate bands on the jaws; a long broad patch on vomer; the two arms of the vomerine teeth united anteriorly into a rounded cluster; the premaxillary band almost entirely exposed throughout its length, when the mouth is closed. Opercle with a single strong spine; preopercular margin very thin, emarginate between three very weak spinous projections; suborbital bones forming the inner and outer boundaries of large sensory canal, the last inner lamina extended backward to within the length of a pupil from the preopercular ridge; gill-rakers 5+18 or 19=23, 6 or 7 rudimentary; pseudobranchiæ large, but two in number on each side; pyloric cœca nine, extended in a broken ring around the gut near the pylorus, one end of the series diverted backward toward end of gall-duct. Scales small, cycloid, deciduous, about 12 from origin of first dorsal to, but not including, lateral lines; fins scaly at base; head completely scaled. Each scale long and narrow, rounded oblong in outline; the focus apicad of middle; circuli not angulated, concentric with scale margin; radii numerous and wide on basal field, but rudimentary or absent on the lateral and exposed fields, where the circuli are joined by reticulations. Lateral lines indistinct, owing to loss of scales, traceable backward about to middle of length of tail. Dorsal and anal continuous with caudal; distance from tip of snout to dorsal origin, 4.0; to anal origin, 2.5; distance of anal from lower end of pectoral base, more than nine-tenths length of head; pectoral fin 2.1, ventral, 3.0 in head.

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[136] Franz, Abh. Bayer, Akad. Wiss., Vol. I, Suppl. 4, 1910, p. 8, pl. 5, fig. 28.

[137] Radcliffe, Proc. U. S. N. M., XLII, 1913, p. 149, pl. 9, fig. 2 (China Sea, off Hong Kong; 524 fathoms).

Color blackish brown, becoming blackish on fins and about the gill-opening and mouth; buccal, branchial, and peritoneal cavities black.

565. [1169] **Hoplobrotula armata** (Temminck and Schlegel).

Shizuoka (Jordan); Kochi (Wakiya); Miyazu. In this genus, the ventrals are inserted far forward under the eye, almost as in *Ophidium*, the species in fact much resembling *Otophidium asiro* in form and color. The scales, however, are different.

Genus WATASEA Jordan and Snyder.

We regard the presence of two instead of a single spine on the preopercle as sufficient ground for the provisional retention of *Watasea* as a genus distinct from *Neobythites*.

566. [1170] **Watasea sivicola** Jordan and Snyder.

Two specimens, 22 and 23 mm. long, one from Aoki at Misaki, the other from Miyasu, Kyoto-Fu, on the Sea of Japan.

These confirm the characters attributed to this species by Jordan and Thompson in 1914.[138] Measurements in hundredths of length to caudal base; length of upper jaw, .11; pectoral fin, .11; ventral fin, .14 or .155; length to anus, .41 or .43; length to dorsal origin, .24 or .26. Dorsal rays, 94 or 95; anal rays, 77 or 79. Dorsal pale, with a dark border posteriorly; anal pale anteriorly, with a dark base, which widens posteriorly; body light brown, paling ventrally, with irregular longitudinal rows of pale circles on dorsal half of sides.

Family BREGMACEROTIDÆ.

567. [1173] **Bregmaceros japonicus** (Tanaka).

Three specimens from the Sea of Japan, from Toyama (Yoshizawa) 50 to 52 mm. long to the caudal fin, show the following characters: Head, 5.6 to 5.9; depth, 6.7 to 7.3; eye, 3.7 to 4.0, equal to or longer than snout. Dorsal rays 1–47, the anterior lobe of the main fin containing 14 or 15 rays, the following rays short and largely disconnected, but gradually becoming more connected and higher backward, until they form the low rounded second dorsal lobe; anal rays, 48 or 49; scales about 63–13. The detached dorsal ray extends only three-fourths the distance from occiput to the origin of the dorsal fin proper; the main dorsal and anal lobes are each higher than the head is long.

Family GADIDÆ.

568. [1174] **Gadus macrocephalus** Tilesius. *Tara* = Cod; *Madara* = True Cod.

Osaka market (Jordan), said to have been shipped from extreme northwestern Japan; Kushiro, (Tanaka).

569. [1175] **Theragra chalcogramma** (Pallas). *Suketo-dara* = Skating-cod.

Noo.

Dorsal rays, 12–17 or 18–19 to 20.

570. [1182] **Physiculus japonicus** Hilgendorf. *Chigo-dara* = Baby Cod.

Lotella phycis Günther, Cat. Fishes Brit. Mus., IV, 1862, p. 346.—Jordan and Snyder, Proc. U. S. N. M., XXIII, 1901, p. 376 (not of Temminck and Schlegel).[139]

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[138] Mem. Car. Mus., Vol. VI, p. 303.

[139] Some other records of "*Lotella phycis*" may refer to this species.

Physiculus japonicus Hilgendorf, Sitzungsb. Ges. Naturf. Freunde, Berlin, 1879, p. 80.—Jordan and Starks, Bull. U. S. Fish Comm. XXII, 1902 (1904), p. 601.—Smith and Pope, Proc. U. S. N. M., XXXI, 1906, p. 494.—Franz, Abh. Bayer. Akad. Wiss., Vol. I, Suppl. 4, 1910, pp. 27, 111, p. 5, fig. 20 and pl. 10, fig. 10 and 11.—Snyder, Proc. U. S. N. M., XLII, 1912, p. 450.—Radcliffe, Proc. U. S. N. M., XLIII, 1912, p. 106.—Jordan and Jordan, Mem. Car. Mus., Vol. X, 1922, p. 23.

Physiculus kaupi Günther, Challenger Reports, Deep Sea Fishes, 1887, p. 88, pl. 17, fig. A. (not of Poey).

Physiculus dalwigkii Steindachner and Döderlein, Denk. Akad. Wiss. Wien, 1887, p. 279.

Shizuaka (Jordan); Misaki (Aoki).

The published figures of this species err in showing the abdomen too long; in Franz's figure of the adult (though not in his figure of the young) the entire anterior portion of the anal is not represented. The origin of the anal lies below the first dorsal fin. Günther's figure shows scales on the vertical fins, which is doubtless an error.

In *Physiculus japonicus* the teeth of the jaws become strengthened outwardly, but are not abruptly larger in an outer series. Highly characteristic of *Physiculus* is the scaleless fossa on the midventral line, underlying a gland having a duct leading to the anus. This structure has been described by Franz for the Japanese species, and we have found a similar fossa in three American species: *fulvus*, *nematopus*, and *rastrelliger*.

Family CORYPHÆNOIDIDÆ (*Macrouridæ*).

571. [1201] **Coryphænoides nasutus** Günther. *Sokodara* = Deep-water Cod.

Misaki (Aoki).

572. [1214] **Cœlorhynchus japonicus** (Temminck and Schlegel).
Hige = Moustache; *Tojin* = Stranger.

Misaki (Aoki).

573. [1205A] **Cælorhynchus gilberti** Jordan and Hubbs, sp. nov.

Type: a specimen 184 mm. long to anus, or 462 mm. long to tip of tail, found by Dr. Jordan in the fish-market at Shizuoka. (C. M. Cat. Fishes, No. 7960.)

This species is entirely unlike any other known from Japan, the Philippines, or the East Indies. It most resembles two Hawaiian species, *C. doryssus* and

C. aratrum, and two Atlantic species, *C. occa* and *C. talismani*, but differs from all in the weaker spination of the scales, the obsolete denticulation on the dorsal spine, the reduction of the teeth in the lower jaw to a single irregular lateral series, in proportionate measurements, etc. Gilbert and Hubbs[140] have published a very useful analytical key to the known species of *Cœlorhynchus*.

First dorsal, II, 8; pectorals, 17–18; ventrals, 7. The dorsal and ventral contours are strongly arched, converging rather gently behind the trunk; dorsal contour of snout very slightly concave; base of first dorsal scarcely oblique. Greatest depth of body below origin of first dorsal 2.35 in length of head; greatest width across pectoral bases, 2.65. Sides of head converging rather evenly in a slightly convex curve to tip of the narrow acuminate snout. Preoral length of snout, 2.5 (2.65); its width at base 3.45; its width at anterolateral angles nearly one-fourth less than its length anterior to that point. The infraorbital, occipital, postorbital, supraorbital, supranarial, and mediorostral ridges are for a *Cœlorhynchus* moderately elevated and spiny; preopercular ridge and margin produced backward; subopercular flap long, pointed, directed downward and backward; orbit an oblong-oval in outline; its length greater than the interorbital width, a little more than twice the least distance between occipital ridges, 4.0 in head, 1.65 in snout, 1.35 in postorbital. Upper jaw extending from below membrane between nostrils to below middle of space between pupil and posterior margin of orbit, its length slightly less than that of orbit, contained 4.15 times in head. Barbel slender and of moderate length, contained 3.75 times in postorbital. Teeth in jaws of moderate size, a little strengthened and enlarged in outer series of the rather narrow premaxillary band; those of the mandible in a narrow band at the symphysis, which narrows to a single irregular row laterally. Six branchiostegals. Distance between isthmus and base of ventral, 1.65 in interval between ventral base and center of anus. An irregular ventral fossa of small size is located on the midventral line, separated by only two scales from the scaleless isthmus. Scales smaller than in many species, being in six or seven rows from the origin of the first dorsal fin to the lateral line, five and one half between the anterior portion of the second dorsal and the lateral line. Scales armed with a median row of strong half-erect imbricate spines, increasing in strength to the last, which extends beyond the scale-margin, and by one to five more or less convergent rows of very much weaker spines on each side; the number of lateral rows averages higher on the tail than on the trunk; one or two rows adjacent to the median one are usually incomplete. Scales on the head and nape between bony ridges are provided with one to five (usually three) strongly divergent rows of large subequal spines. Scales of the infraorbital ridge from tip of snout to below middle of eye in a single series, bearing rows of spines radiating everyway from a point near the lower front corner of the scales; scales on posterior half of the ridge in two series, bearing fewer but stronger ridges; last scale is unpaired, armed with spines of especial strength. Terminal rostral scale forming a moderately sharp straight-edged, slightly depressed spine, bearing about twelve radiating rows of spines. The nine scales which follow on the median rostral ridge are highly specialized; the first shield-shaped, broader anteriorly; the second very long and slender, widening posteriorly; the next six with parallel sides and posterior margins forming obtuse angles; the last produced backward, but not pointed; all bearing numerous rows of spines radiating in every direction from near the front margin. Scales on ridges about the eye somewhat resembling those of infraorbital ridge, but on those of the occipital ridges the spines are very strong, and largely restricted to a single row; median occipital scute, preceded by a small naked area and armed by three strong imbricate spines and one other; under surface of head wholly scaleless. Second dorsal spine weak, smooth, flexible distally, only slightly produced beyond the soft rays, its length contained 2.9 times in head. First dorsal base slightly shorter than interdorsal space, contained 2.35 times in postorbital; first ray of second dorsal nearly as long as pupil. Pectoral bluntly pointed, its length about equal to postorbital, or to outer ventral ray, which is filamentous, about one-half longer than the next ray, not nearly reaching anus.

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[140] See Bulletin U. S. N. M., 100, 1920, p. 432.

Color pale brown, nearly uniform; lining of buccal cavity gray; that of branchial cavity, blackish; first dorsal dark dusky, lighter at base; second dorsal and anal black; pectoral and ventrals blackish.

Measurements in hundredths of length to anus; (184 mm.) length of head, .076; orbit, .19; postorbital, .255; least interorbital width, .165; least suborbital width, .10; distance between orbit and angle of preopercular margin, .26; preocular length of snout, .32; preoral length of snout, .30; width of snout, at base, .23; width of snout at end of ethmoid portion of infraorbital ridge, .185; barbel, .07; depth of body below origin of first dorsal, .32; width over pectoral bases, .295; center of anus to base of outer ventral ray, .25; ventral base to isthmus, .19; height of second dorsal spine, .255; length of first dorsal base, .11; interdorsal space, .105; length of pectoral, .25; length of outer ventral ray, .25.

In general outline, Gilbert's figure of *C. doryssus* fits this species almost perfectly.

Family LOPHIIDÆ

574. [1218] **Lophiomus setigerus** (Vahl). *Anko* = Sea-devil.

Tokyo and Osaka markets (Jordan); Wakanoura (Yamamoto); Kochi; Kagoshima Bay (Wakiya); Misaki (Aoki); Miyazu.

In the young the tongue is black, with white spots, but this color becomes faded and indefinite with age.

Family ANTENNARIIDÆ

575. [1219, 1220, 1221, 1222] **Antennarius tridens** (Temminck and Schlegel). *Izari-uwo* = Cripple-fish.

In a series from Misaki (Aoki), there are represented the color phases, which have been named *tridens*, *scriptissimus*, *sanguifluus* and *nox*; we think all these are forms of one highly variant species, as Franz, with Jordan, Tanaka, and Snyder have already indicated. They are all apparently color-phases of a single species which widely varies in coloration, according to its environment. The form called *tridens* is by far the most abundant, being found at a less depth than the others.

Family CHAUNACIDÆ

576. [1225] **Chaunax fimbriatus** Hilgendorf. *Dainan-okose* = Danger Sting-fish.

One specimen 80 mm. long from tip of snout to caudal, Kagoshima, (Wakiya).

Upper parts covered with round dark spots. Dorsal rays, 10; anal, 7. The spinules are sharp and coarse. This specimen was obviously taken with the abdominal sac dilated, and the pelvic fins entirely retracted, in the fashion of a glove, so that at first sight they seem to be wanting.

Family OCCOCEPHALIDÆ

577. [1228] **Halieutæa stellata** (Vahl). *Akagutsu* = Red Gutsu.

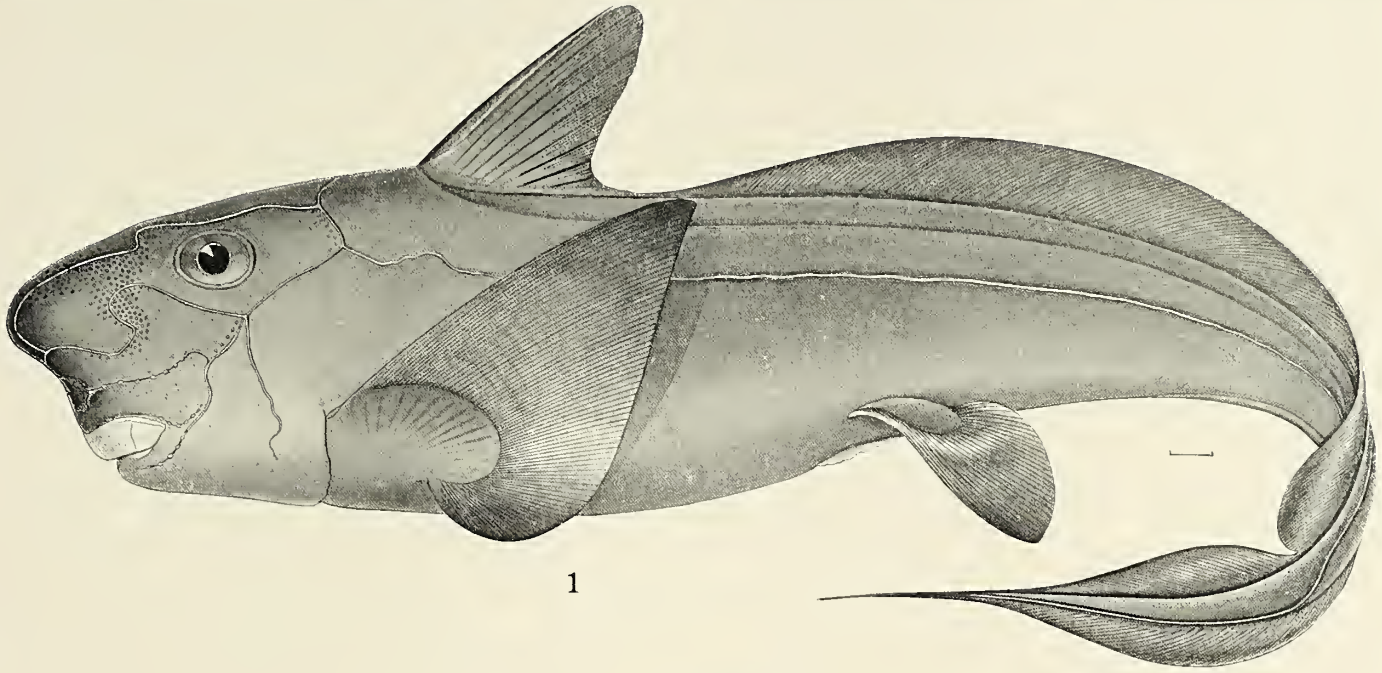
Misaki (Aoki); Fukui (Nonaka).

EXPLANATION OF PLATE V.

Fig. 1. *Psychichthys eidolon*, Jordan and Hubbs, sp. nov. *Type*, from Misaki, Japan. (C. M. Cat. Fishes, No. 7779.)

Fig. 2. *Oncorhynchus adonis* Jordan and McGregor, sp. nov. *Type*, from Lake Hakone, Sagami, Japan. (C. M. Cat. Fishes, No. 7784.)

Fig. 3. *Oncorhynchus kawamuræ* Jordan and McGregor, sp. nov. *Type*, from Lake Toyama, Ugo, Japan. (C. M. Cat. Fishes, No. 7785.)



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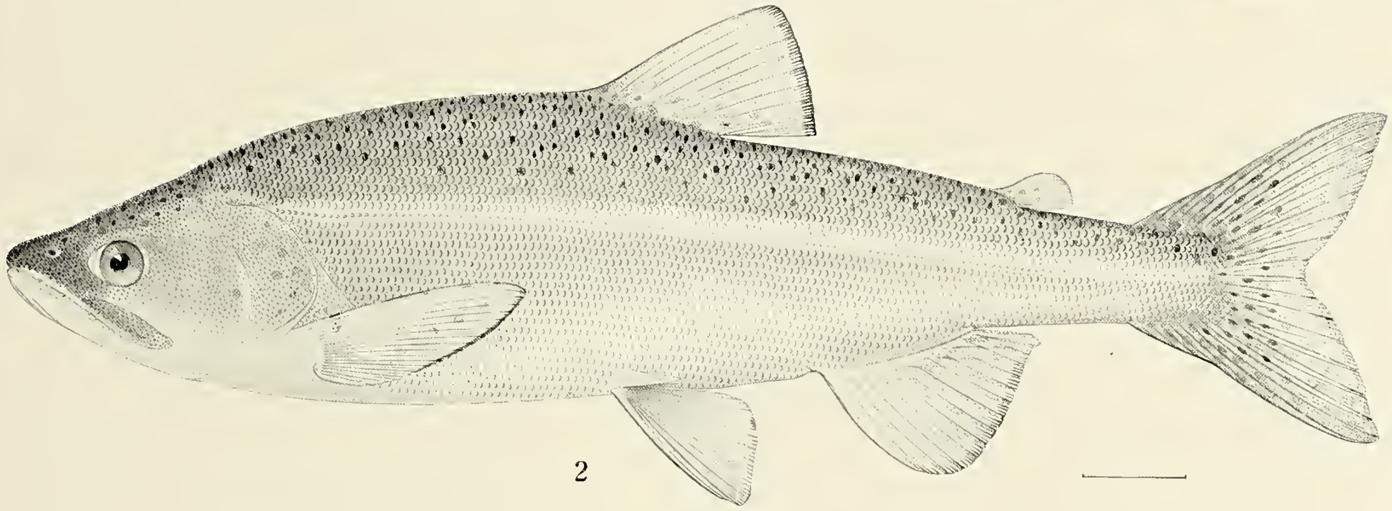

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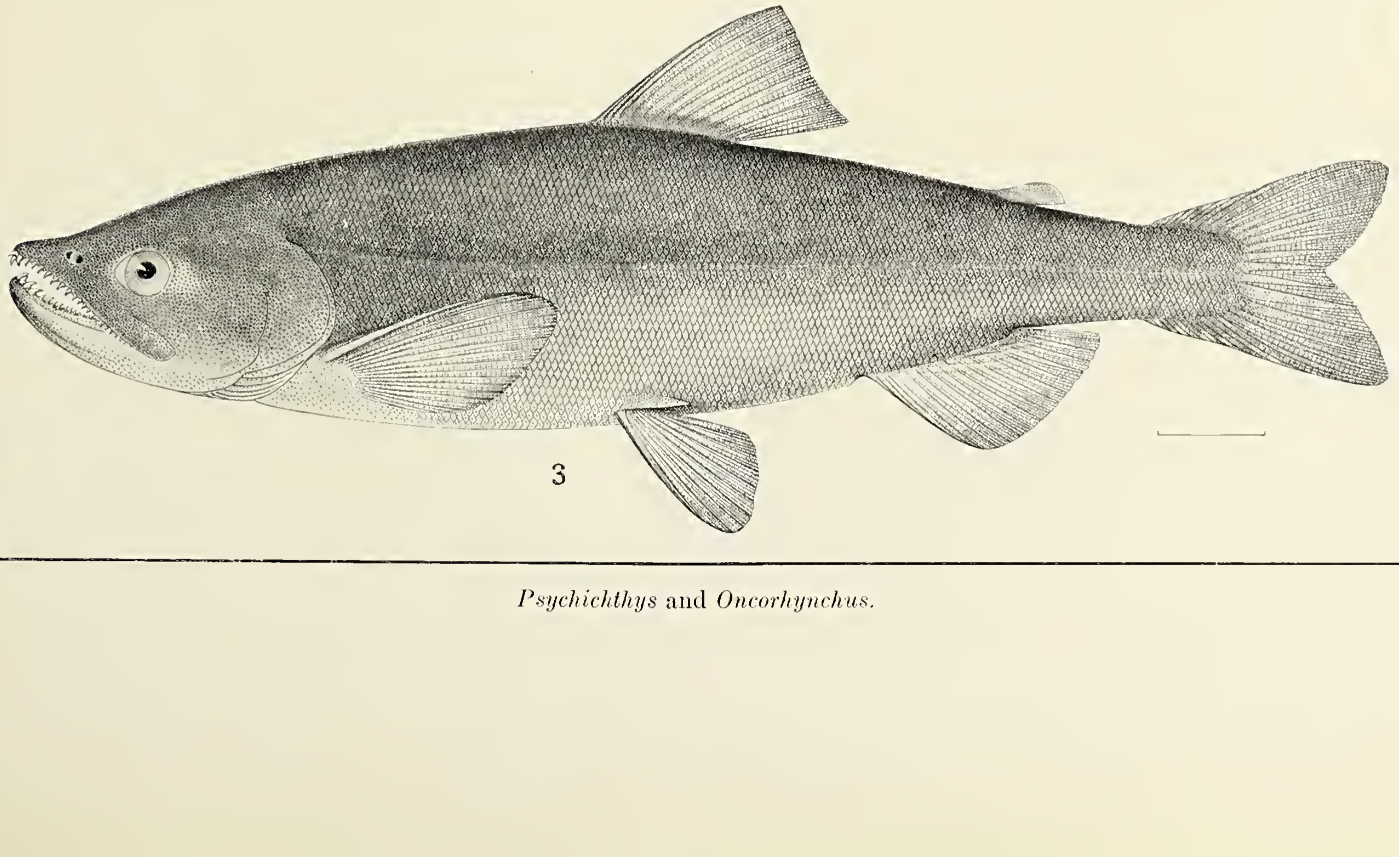

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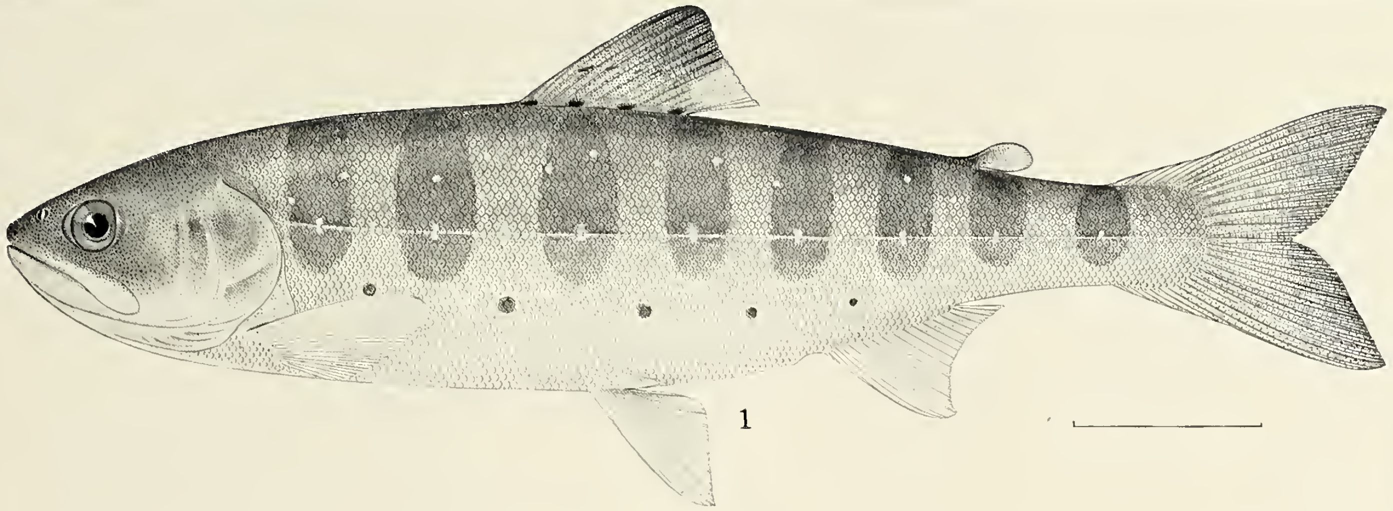
Psychichthys and *Oncorhynchus.*

EXPLANATION OF PLATE VI.

Fig. 1. *Oncorhynchus ishikawæ* Jordan and McGregor, sp. nov. *Type.* Lake Biwa at Otsu, Japan. (C. M. Cat. Fishes, No. 7786.)

Fig. 2. *Oncorhynchus macrostomus* (Günther). Lake Biwa at Otsu, Japan. (C. M. Cat. Fishes, No. 7791.)

Fig. 3. *Oncorhynchus macrostomus* (Günther). *Type.* Lake Hakone, Japan. (C. M. Cat. Fishes, No. 7790.)



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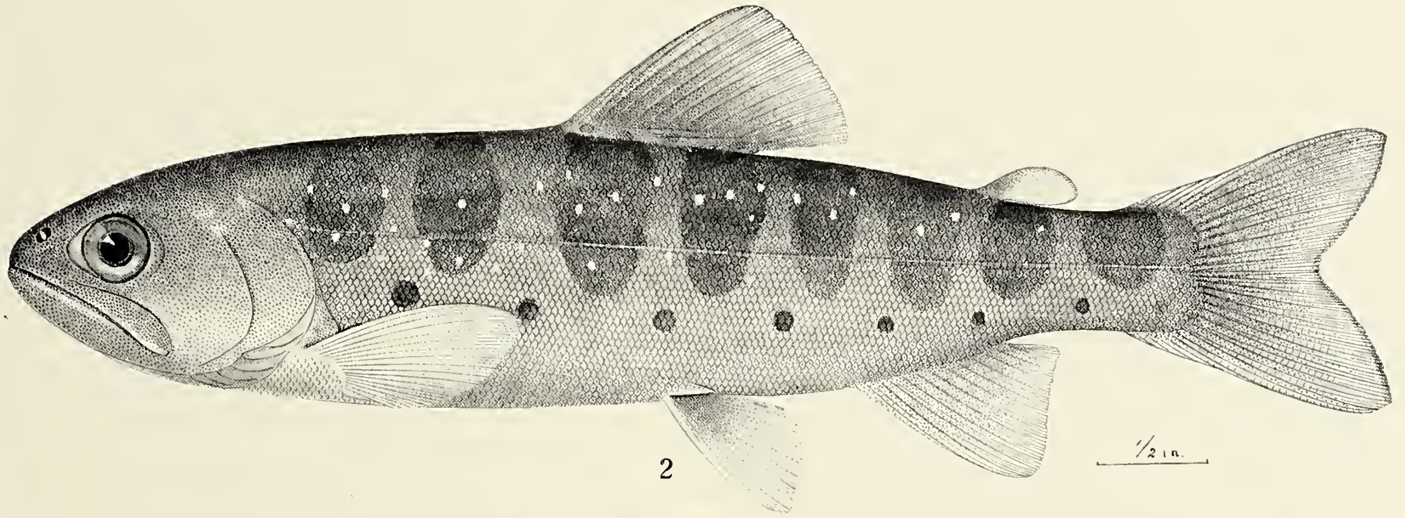

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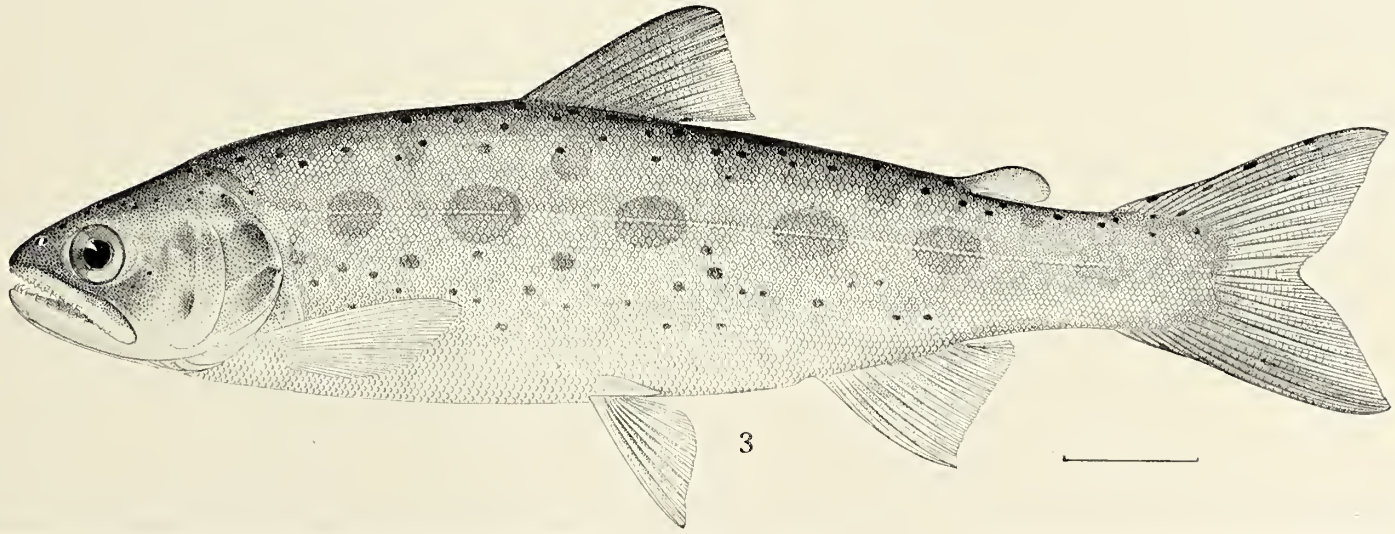

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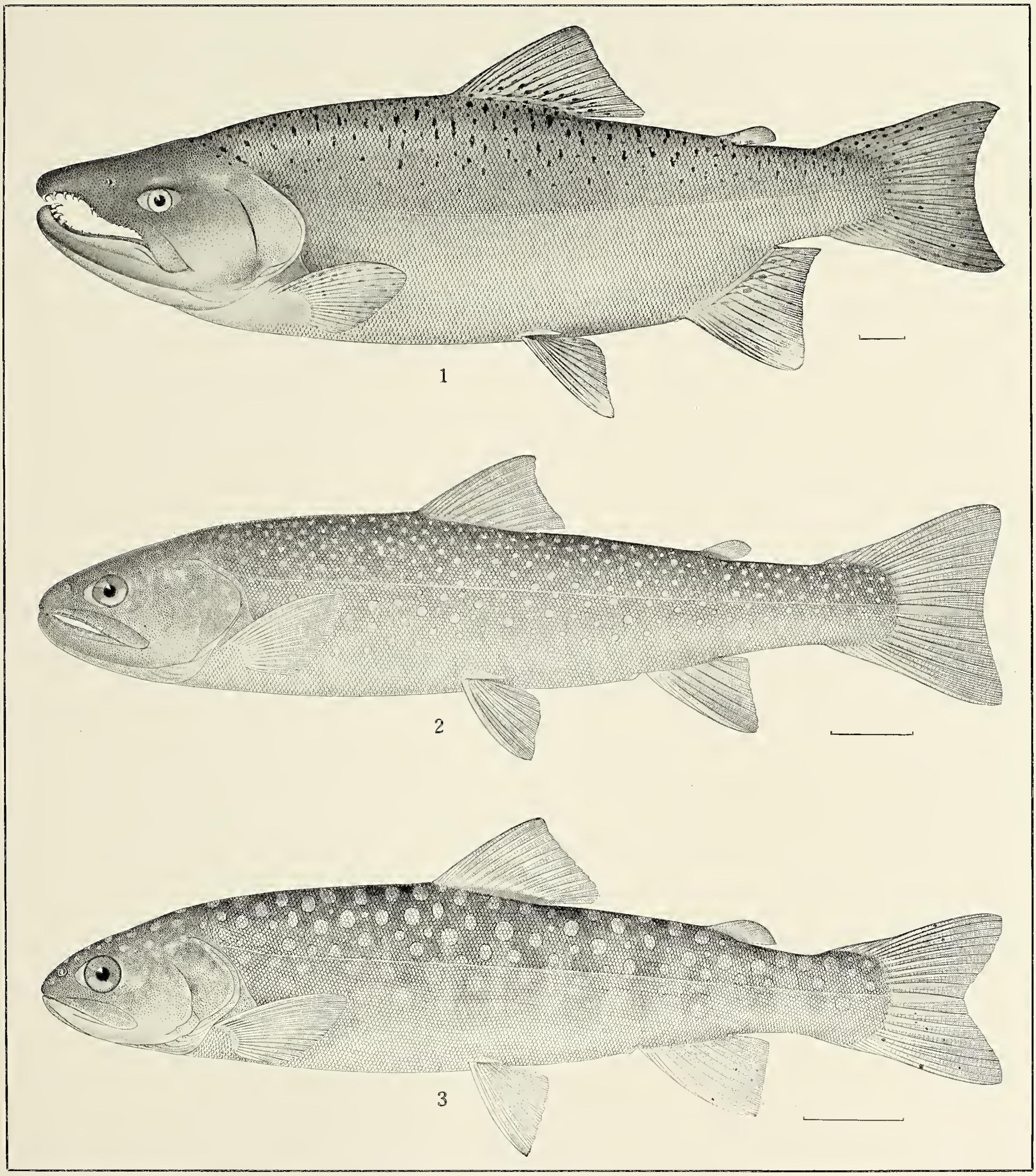
Oncorhynchus.

EXPLANATION OF PLATE VII.

Fig. 1. *Oncorhynchus rhodurus* Jordan and McGregor, sp. nov. *Type.* Lake Hakone, Sagami, Japan. (C. M. Cat. Fishes, No. 7794.)

Fig. 2. *Salvelinus pluvius* (Hilgendorf). Shinshu near Nagano, Japan. (C. M. Cat. Fishes, No. 7796.)

Fig. 3. *Salvelinus imbrius* Jordan and McGregor, sp. nov. *Type.* Hamada, Iwami, Japan. (C. M. Cat. Fishes, No. 7797.)



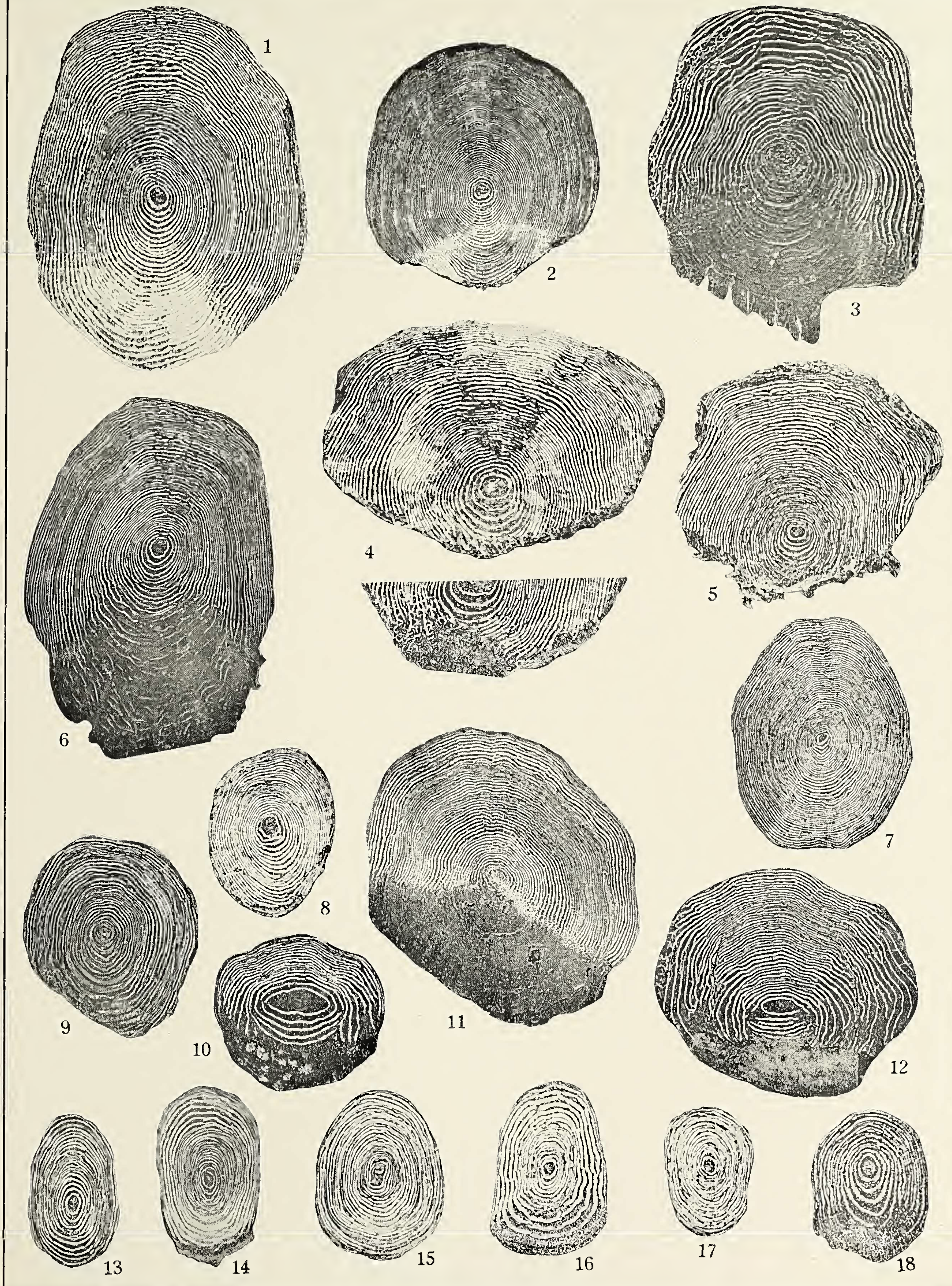
Oncorhynchus and *Salvelinus*.

EXPLANATION OF PLATE VIII.

(Scales of Japanese Salmonidæ.)

FIG. 1. *Oncorhynchus rhodurus* Jordan and McGregor, Lake Hakone.
FIG. 2. *Oncorhynchus rhodurus* Jordan and McGregor, Lake Hakone.
FIG. 3. *Oncorhynchus gorbuscha* (Walbaum), Hokkaido.
FIG. 4. *Oncorhynchus adonis* Jordan and McGregor, Lake Hakone.
FIG. 5. *Oncorhynchus kawamuræ* Jordan and McGregor, Ugo.
FIG. 6. *Oncorhynchus ishikawæ* Jordan and McGregor, Lake Hakone.
FIG. 7. *Hucho perryi* (Brevoort), Naoetsu, Echigo.
FIG. 8. *Oncorhynchus macrostomus* (Günther), Shibukawa.
FIG. 9. *Oncorhynchus macrostomus* (Günther), Shibukawa.
FIG. 10. *Plecoglossus altivelis* Temminck and Schlegel, Korea.
FIG. 11. *Oncorhynchus keta* (Walbaum), Sapporo.
FIG. 12. *Plecoglossus altivelis* Temminck and Schlegel, Kumamoto.
FIG. 13. *Salvelinus leucomænis* (Pallas), Petropavlovsk.
FIG. 14. *Salvelinus pluvius* (Hilgendorf), Shinshu.
FIG. 15. *Salvelinus imbrius* Jordan and McGregor, Iwame.
FIG. 16. *Salvelinus malma* (Walbaum), Pt. Hope, Alaska.
FIG. 17. *Salvelinus spectabilis* Girard, Montana.
FIG. 18. *Oncorhynchus formosanus* (Jordan and Oshima), Saramoa, Formosa.

Plate VIII.



Scales of Japanese *Salmonidæ*.

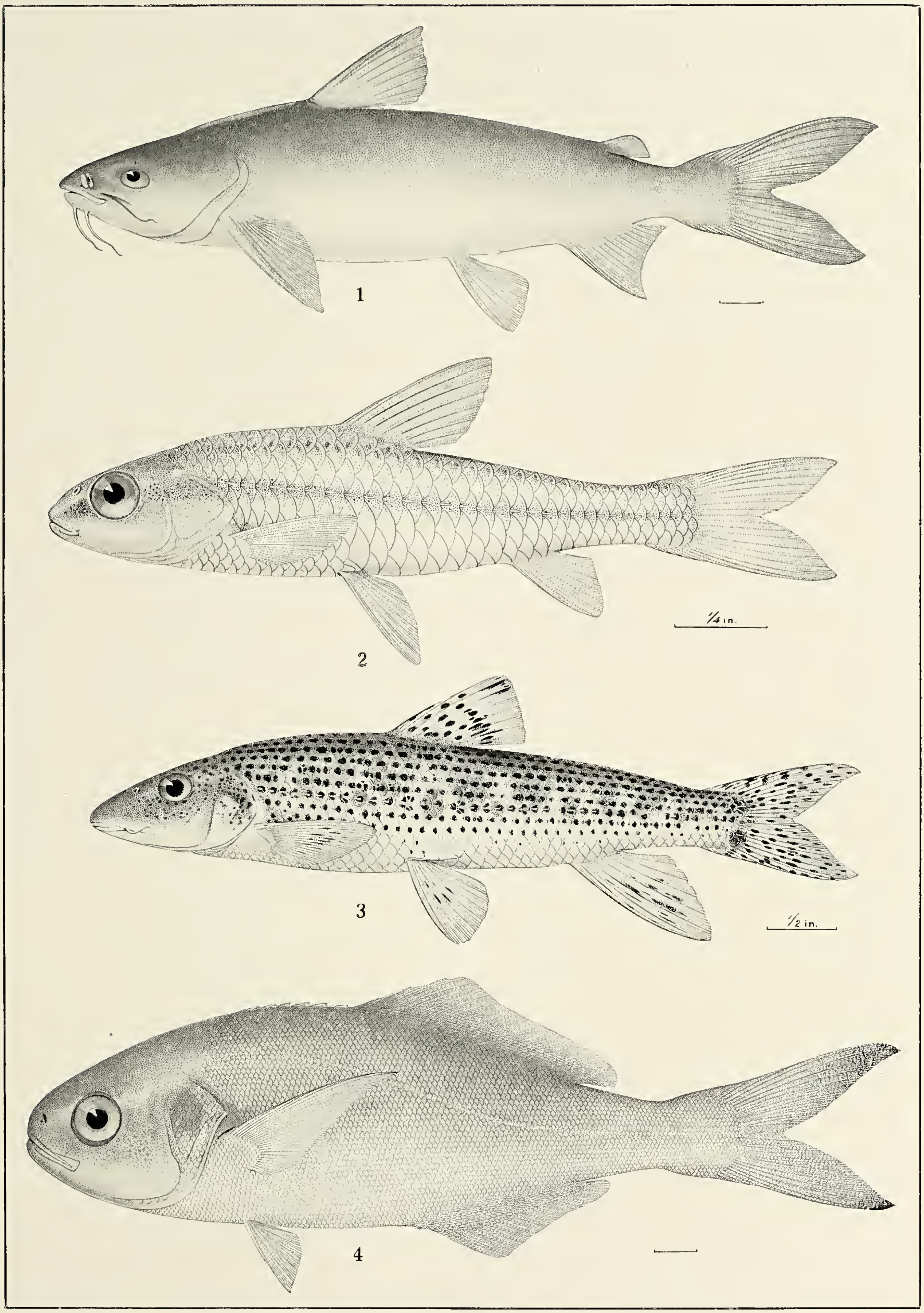
EXPLANATION OF PLATE IX.

Fig. 1. *Netuma osakæ* Jordan and Kasawa, sp. nov. *Type.* Osaka, Japan. (C. M. Cat. Fishes, No. 7808.)

Fig. 2. *Gnathopogon majimæ* Jordan and Hubbs, sp. nov. *Type.* Ping-yang River, Korea. (C. M. Cat. Fishes, No. 7816.)

Fig. 3. *Belligobio eristigma* Jordan and Hubbs, sp. nov. *Type.* Okayama, Japan. (C. M. Cat. Fishes, No. 7820.)

Fig. 4. *Ocyerius japonicus* (Döderlein), gen. nov. Tokyo market, Japan. (C. M. Cat. Fishes, No. 7859.)



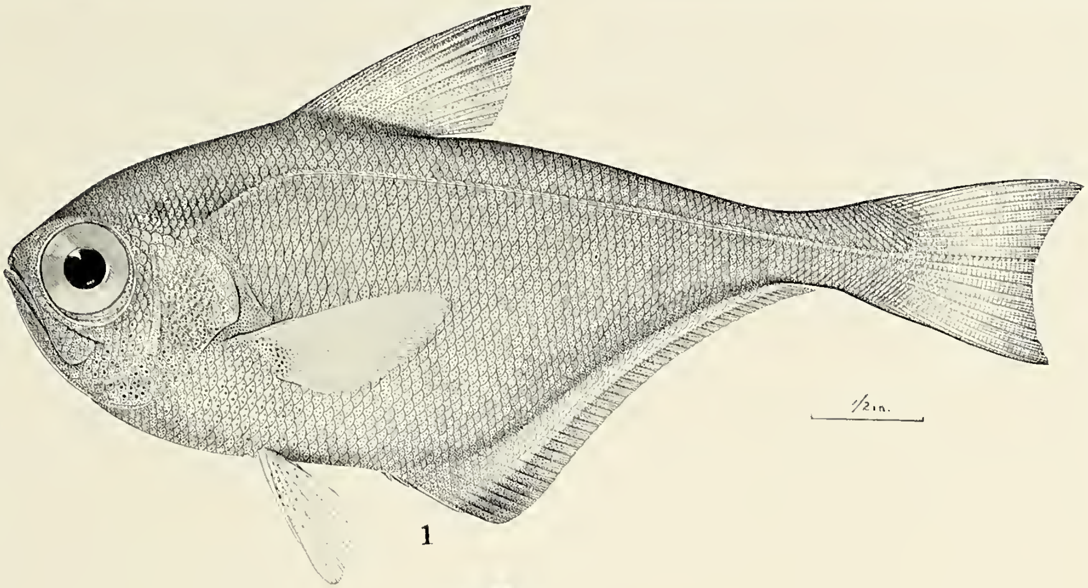
Netuma, Gnathopogon, Belligobio, Ocycrius.

EXPLANATION OF PLATE X.

Fig. 1. *Liopempheris sasakii* Jordan and Hubbs, sp. nov. *Type.* Toba, Shima, Japan. (C. M. Cat. Fishes, No. 7860.)

Fig. 2. *Malakichthys wakiyæ* Jordan and Hubbs, sp. nov. *Type.* Kagoshima, Japan. (C. M. Cat. Fishes, No. 7863.)

Fig. 3. *Brachirus bellus* Jordan and Hubbs, sp. nov. *Type.* Misaki, Sagami, Japan. (C. M. Cat. Fishes, No. 7894.)



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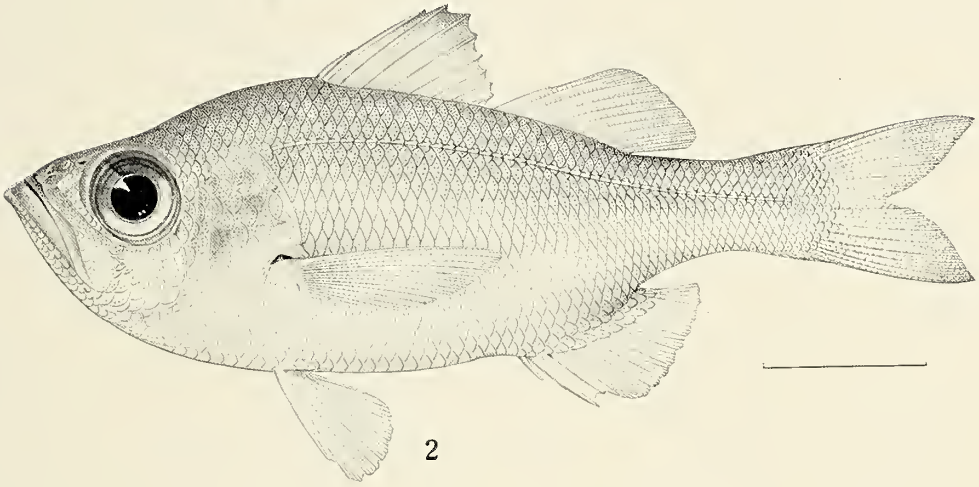

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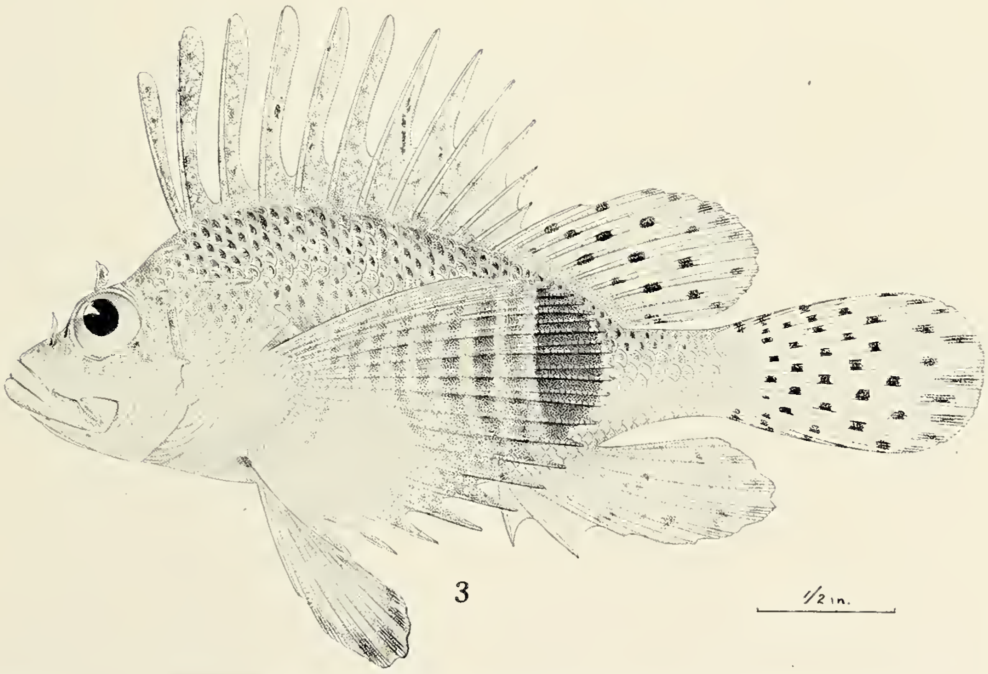

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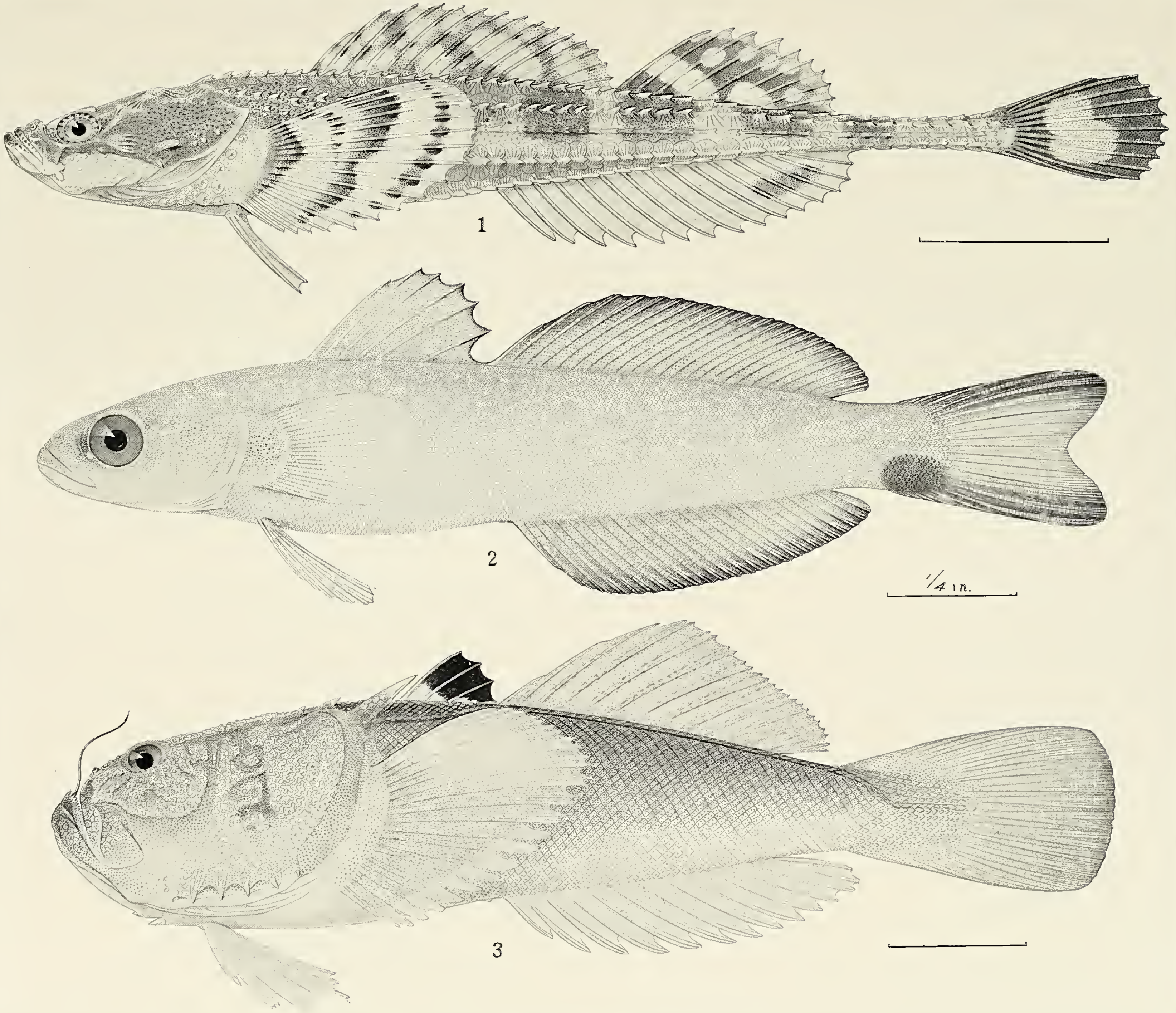
Liopempheris, Malakichthys, Brachirus.

EXPLANATION OF PLATE XI.

Fig. 1. *Iburiella kasawæ* Jordan and Hubbs, sp. nov. *Type.* Kushiro, Japan. (C. M. Cat. Fishes, No. 7906.)

Fig. 2. *Encæura cvides* Jordan and Hubbs, sp. nov. *Type.* Wakanoura, Japan. (C. M. Cat. Fishes, No. 7931.)

Fig. 3. *Zalescopus tosæ* Jordan and Hubbs, sp. nov. *Type.* Kachi River, near Nagoya, Japan. (C. M. Cat. Fishes, No. 7945.)



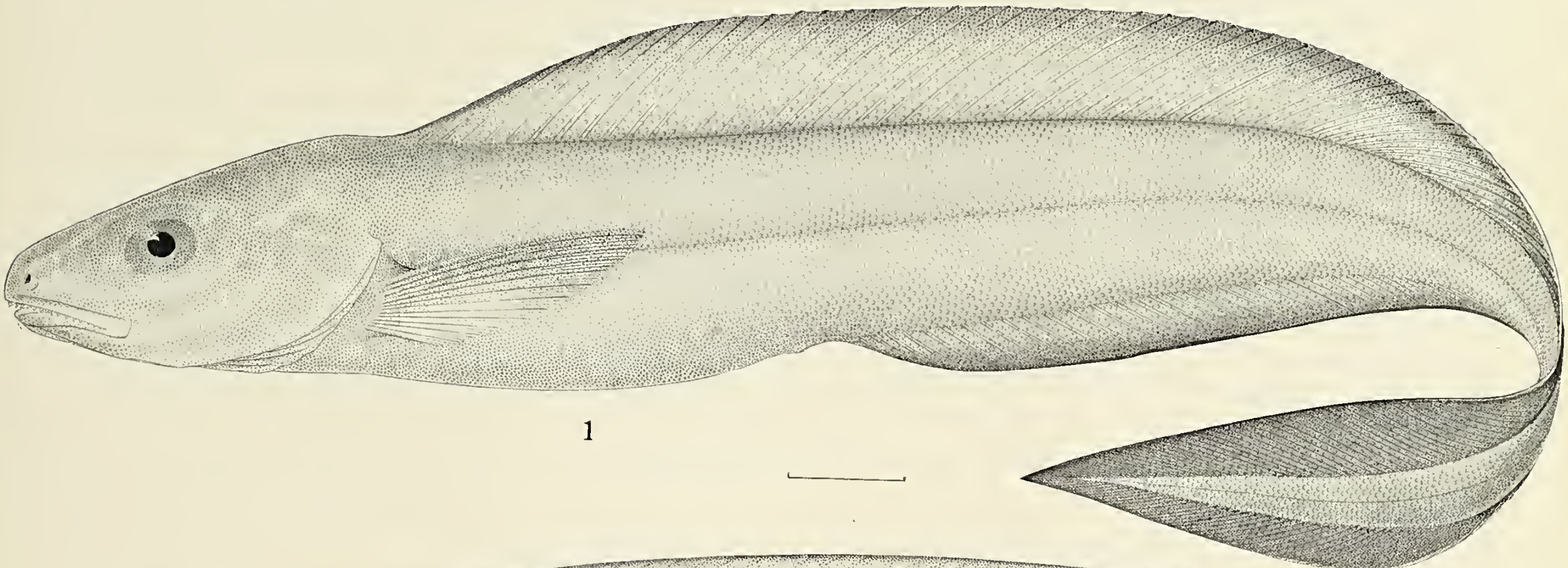
Iburiella, Encœura, Zalescopus.

EXPLANATION OF PLATE XII.

Fig. 1. *Zestichthys tanakæ* Jordan and Hubbs, sp. nov. *Type.* Kushiro, Japan. (C. M. Cat. Fishes. No. 7951.)

Fig. 2. *Allolepis hollandi* Jordan and Hubbs, sp. nov. *Type.* Fukui, Japan. (C. M. Cat. Fishes, No. 7952.)

Fig. 3. *Monomitopus kumæ* Jordan and Hubbs, sp. nov. *Type.* Misaki, Japan. (C. M. Cat. Fishes. No. 7954.)



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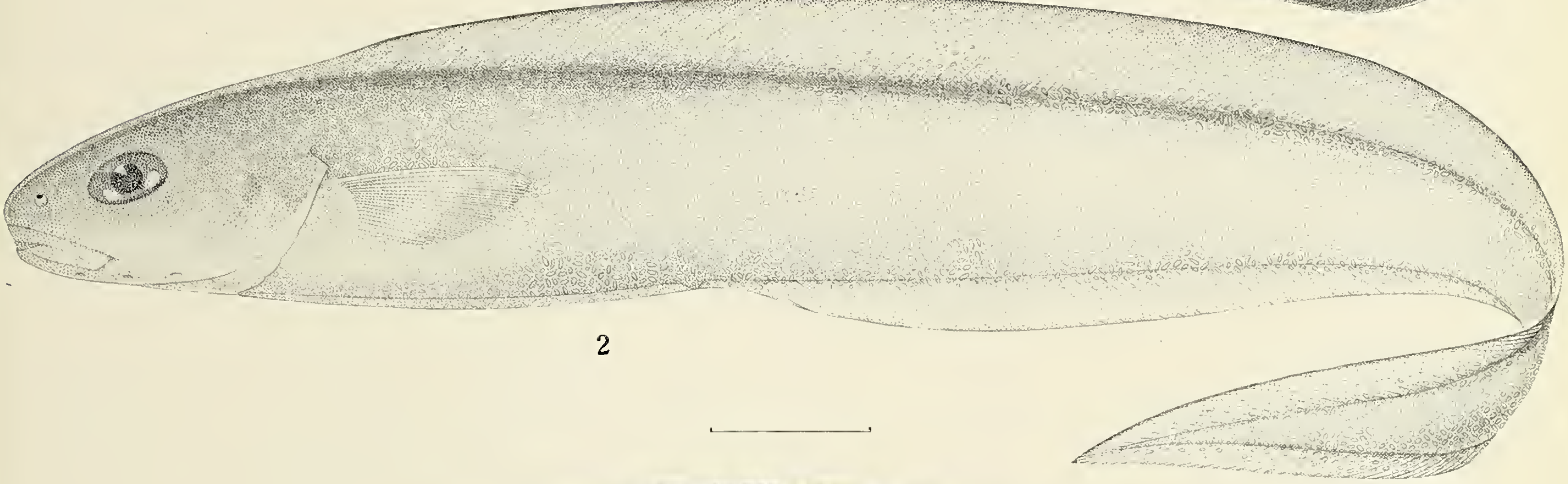

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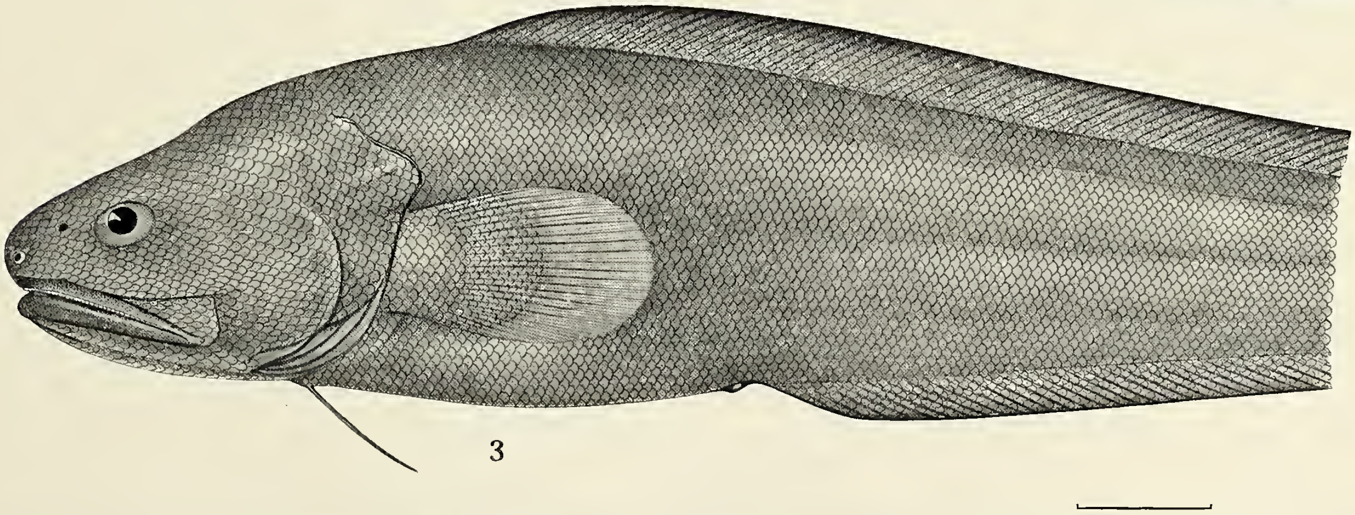

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Zestichthys, Allolepis, Monomitopus.